III. RESPONDENTS' WITNESSES.

* Indicates injury with Hand Power Gear.

† Indicates injury with Power Reverse Gear.

Name	Age	Occupation	Railroad	Years of Engine Service	Record	Abstract
Adams, A. C.	65	Supt. M. P.	Nor. Southern	47	931–938	20, 30, 39, 91
†Aita, John	47	Engineer	Union Pacific	29	701–705	81, 107, 118, 130, 145
†Arnold, L. W.	36	Fireman	N. C. & St. L.	13	1165–1166	160
††Bailey, W. H.	58	Engineer	Union Pacific	27	1102–1106	22, 92, 111, 132, 153
Baker, J. E.	49	Engineer	W. Maryland	28	943	150
Barker, J. H.	42	Engineer	W. Maryland	24	946–949	21, 30, 91
†Bates, E. G.	64	Engineer	C. & N. W.	44	684	15, 28, 106, 118, 130, 143
†Beach, Alanson	30	Fireman	Union Pacific	9	705–708	81, 107, 118, 145
Beach, W. S.	54	Engineer	Union Pacific	40	699–701	16, 28, 37, 107, 130
Beecher, Chas. E.	43	Engineer	Reading	20	863–865	19, 88, 109, 131
†Von Bergen, E.		Gen. Air Brake Insp.	Ill. Central	30	1177–1192	22, 39, 93, 111, 123, 133, 161
Bieri, R.	48	Engineer	N. Y. C. & St. L.	28	843–845	87, 109, 120
Bjorkholm, J. E.		Asst. Supt. M. P.	C. M. St. P. & P.		1192–1202	22, 94, 123, 133
†Black, M. A.	35	Fireman	Me. Central	13	1169	161
†Blowers, Henry E.	63	Engineer	C. & N. W.	49	635–637	36, 78, 105, 117, 129, 140
Bobbitt, Howard	55	Rd. Fore. Engs.	Nor. Southern	39	938–943	21, 39, 91, 110, 122, 132
Boh, George M.		Rd. Fore. & Fuel Su.	Erie	28	1267–1272	124
†Brotherton, R.	49	Engineer	B. & O.	32	481–496	12, 25, 35, 72, 103, 128, 136
†Brown, Richard		Laborer	A. T. & S. F.		1158	158
†Buckner, S. J.	54	Engineer	Ill. Central	27	669–670	15, 27, 37, 80, 106, 141
Buell, G. C.	67	Engineer	Ill. Central	44	554–557	13, 26, 36, 104
†††Burkhalter, C. W.	57	Engineer	C. B. & Q.	35	690–695	16, 80, 106, 118, 130, 144
††Burnett, J. W.	41	Asst. Gen. S. M. P. & M.	Union Pacific	25	1109–1136	22, 31, 39, 92, 111, 122, 132, 154
Butler, Walter E.	47	Engineer	W. Maryland	31	949–955	21, 30, 91, 111, 122, 132, 151
††*Canady, B. H.		Machinist	A. T. & S. F.	21	1143–1154	62, 92, 133, 156
Carryer, H. E.	59	Machinist Helper	W. Maryland		944–945	151
Cartwright, K.		Asst. Mech. Engr.	N. Y. N. H. & H.		1295–1300	
Chashman, E. A.	46	General Foreman	W. Maryland	30	945–946	
†Cherry, W. H.	56	Engineer	N. C. & St. L.	31	1166–1168	93, 160
Ciliske, A. I.		Mech. Inspector	Am. Ry. Ass'n.		1294 1315	
†Colache, Joseph		Hostler	Penna.		803	148

Name	Age	Occupation	Railroad	Years of Engine Service	Record	Abstract
†Collinson, A. M.		Brakeman	S. P.		1323	167
†Cooksey, B. B.	48	Engineer	S. P.	24	813–819	28, 86, 108, 148
Cooper, F. C.	55	Engineer	N. Y. C. & St. L.	25	841–842	19, 29, 87, 120
Cosper, H. L.	44	Rd. Foreman Engs.	Wabash	24	865–877	19, 88, 109, 121, 132
Costley, A. J.	46	Engineer	T. & N. O.	28	832–834	18, 29, 86, 109, 120
Cotton, Wm. A.		Mech. Assistant	Erie	40	1263–1264 1323–1324	
†Coyle, Edwin C.	47	Engineer	Nor. Pacific	27	766–772	17, 108, 119, 131, 147
Crabbs, W. J.		Engineer	Western Md.	30	1238–1246	95, 124, 134
†Crase, A.		Engineer	A. T. & S. F.		1160–1161	158
Crowley, Daniel F.	68	Engineer	Ill. Central	41	547–550	13, 26, 36, 104, 128
†Crystal, Miles	39	Engineer	Ill. Central	19	550–552	13, 26, 128, 137
Cunningham, W. P.		Supt.Motive Power	Monongahela		1290–1294	96
Curtis, J. H.		Division Supt.	B.& Aroostook	30	725–728	16, 37, 107
†Dalzell, J. H.	45	Engineer	Union Pacific	26	1087–1095	21, 30, 91, 111, 122, 151
*Dampman, H. J.	55	Engineer	Reading	42	851–856	19, 38, 62, 87, 121
†Dickhaut, W. G.	49	Engineer	N. Y. C	32	886–887	110, 121, 149
Dittbrenner, H. F.		Statistician	C. R. I. & P.	29	689–690	
Doolittle, W. J.	53	Engineer	Ill. Central	32	668–669	15, 27, 37, 106
Edmonds, Geo. S.		Supt. M. P.	D. & H.	20	684–687	
Elliott, L. E.		Water Engineer	St. L. S. F.		599–602	
*Ellis, Frank		Gen.AirBrakeInsp.	St. L. S. F.	35	602–612	14, 36, 61, 76, 105, 117, 138
†Emsworth, H. L.	47	Engineer	Erie	29	1315–1316	165
†Evans, Edgar	43	Machinist	D. L. & W.	29	1209–1211	162
Fields, J. R.	56	Engineer	Ill. Central	40	666–668	15, 27, 36, 106
Fitzgerald, J. J.	45	Engineer	N.Y.N.H.& H.	29	916–919	20, 29, 38, 90, 121, 132
Flynn, J. F.		Engineer	C.St.P.M.& O.	29	840–841	18, 29, 38, 87, 109, 120, 131
Ford, A. B.		Master Mechanic	Great North.	36	1301–1303	23, 41, 96, 112
†Fraley, Junior B.	46	Fireman	B. & O.	21	454–470	12, 71, 103, 115, 127, 135
Fraley, Roy	52	Engineer	B. & O.	35	470–481	65, 72, 103, 115, 128
Freeland, B. F.	59	Engineer	B. & O.	33	523–527	26, 35, 73, 103, 128
†Gallagher, Thos. E.	63	Engineer	A. T. & S. F.	39	1163–1165	159
Geldbaugh, J. E.	55	Engineer	B. & O.	36	425–443	11, 25, 35, 70, 102, 115, 127
Gerbes, C. J.		Master Mechanic	Erie		1266–1267	
†Glover, E. C.	38	Engineer	A. C. L.	17	1204–1207	94, 111
Goodwin, Geo. S.		Asst.to Gen.S.M.P.	C. R. I. & P.	26	687–689	
Gorman, E. R.		Supt., M. P. & M.	C.St.P.M.& O.	30	1274–1282	22, 40, 96, 125, 134

Name	Age	Occupation	Railroad	Years of Engine Service	Record	Abstract
†Hailey, W. S.	50	Engineer	N. C. & St. L.	29	1168–1169	161
Haine, J. H.	58	Engineer	Penna.	33	802–803	18, 38
Hall, E. B.		Gen.Supt.M.P.&M.	C. & N. W.	42	1211–1233	22, 31, 39, 94, 112, 123, 133, 163
Harris, J. C.	64	Mast. Mechanic	T. & N. O.	43	819–831	18, 29, 86, 108, 120, 131
†Harris, W. P.	54	Engineer	N. & W.	33	1315	23, 97, 164
*Hayes, G. B.	64	Hostler	A. C. L.		1207–1209	63, 162
†Heck, F. W.	44	Engineer	Ill. Central	26	695–697	16, 28, 81, 130, 144
†Heirgood, Wm.	67	Engineer	A. T. & S. F.	34	1140–1141	155
†Henry, O. E.	57	Engineer	Penna.	30	803–805	148
†Herrick, H.		Engineer	C. & N. W.	30	578–587	14, 75, 104, 116, 129
Hert, G. E.	47	Asst. Rd. F. Engs.	Penna.	22	807–808	28, 86, 119, 131
Hintz, Charles	59	Engineer	C. & N. W.	34	643–647	78, 105, 131
Hoeft, H.	45	Engineer	Great North.	27	775–782	17, 37, 84, 119
Holmquist, Elmer	53	Master Mechanic	C. & N. W.	33	708–712	81, 130, 145
Horan, Thomas	47	Engineer	Reading	25	860–862	19, 29, 87, 109, 121, 131, 149
†Hughes, John J.	42	Asst. Foreman	C. R. R. N. J.		1202–1204	94, 161
Ingling, J. E.		Gen.Supv.F.& L.	Erie	20	1264–1266	95, 134
Ingram, T. W.	38	Engineer	N. & W.	19	792–794	85, 119
Jeffers, C. A.	53	Fuel Supervisor	C. & N. W.	35½	649–655, 656–666, 681	36, 79, 106, 117, 129, 140
Jenness, D. H.	52	Rd.Foreman Engs.	Penna.	31	809–811	120, 131
Johnson, Geo. W.	56	Engineer	Nor. Pacific	36	772–775	17, 108
Jones, James F.	55	Engineer	N.Y.N.H.& H.	31	919–927	20, 30, 39, 90, 110, 122, 132
Jones, W. N.		Claim Agent	C. & A.		811–813	
Kerby, Frederick		Asst. to Chf.M.P.	B. & O.	51	1304–1309	23, 41, 96, 125
†Kiely, James	65	Rd. House Fore.	A. T. & S. F.	53	1159–1160	158
†King, Geo. E.	70	Engineer	A. T. & S. F.	41	1142–1143	156
Knight, W. G.		Mechanical Supt.	B.& Aroostook	30	719–725	16, 37, 82, 130
†Lambright, R. I.		Former fireman	N. Y. C.		1316–1318	165
†Landers, Edward	54	Engineer	N.Y.N.H.& H.	33	927–928	20, 30, 39, 90, 110, 150
†Law, C. W.	61	Engineer	A. T. & S. F.	32	1139–1140	155
Lemhkuhle, H. L.		General Accountant	N.Y.C.& St.L.		1233–1235	
LePage, E. E.	59	Engineer	C.St.P.M.& O.	39	834–840	18, 29, 86, 109, 120, 131
†Lieber, A. W.	46	Engineer	N.Y.C.& St.L.	19	845–846	87, 131, 149
Lindquist, O. B.	51	Engineer	C. & N. W.	29	647–649	27, 78, 106, 117, 129
Loshbaugh, G. E.	55	Engineer	Union Pacific	34	697–699	16, 37, 81, 107
Love, M. G.	53	Engineer	Nor. Pacific	32	751–753	17, 83, 108
††Maloney, John	61	Engineer	C. & N. W.	30	1246–1249	31, 95, 112, 124, 163
†McCaskill, C. P.	56	Engineer	Ill. Central	32	552–554	13, 26, 36, 75, 104, 116, 138

Name	Age	Occupation	Railroad	Years of Engine Service	Record	Abstract
McFarland, F. R.		Shop Foreman	B. & O.	32	528–539	74
*McGuire, A. C.		Genl. Foreman	C. R. I. & P.	18	713–715	61
†McPhail, O. G.	57	Fuel Supr.	L. & N.		897–900	19, 38, 89, 132, 150
Meyer, F. C.	56	Engineer	C. & N. W.	39	637–639	14, 27, 36, 105
Miller, Fred J.		Dist. Claim Agent	N. Y. C.		1318	166
†††Molte, S. W.		Engineer	S. P.	34	1318–1323	23, 41, 135, 166
†Moore, B. F.	37	Engineer	A. T. & S. F.	13	1138–1139	155
Moriarty, G. A.		Gen. Mech. Supt.	N. Y. N. H. & H.	24	1250–1263	40, 95, 124, 134
†Murphy, J. C.	66	Rd.Foreman Engs.	Nor. Pacific	44	737–741	82, 119, 147
†Nye, John		Machinist	D. & R. G.	29	1235–1238	95, 163
†Olsen, A.	51	Engineer	C. & N. W.	28	619–625	14, 77, 105, 117, 129, 138
O'Neill, Frank	49	Engineer	Great North.	31	788–792	18, 28, 38, 84, 119, 131
Outcalt, Wm. H.	43	Asst. Rd. F. Engs.	Penna.	25	808–809	86
Parmelee, Julius H.		Director	Bu. Ry. Econ.		1300–1301 1310–1314	
†Pearson, L. A.	32	Fireman	A. T. & S. F.		1141	156
Pectal, Wm. E.	55	Engineer	N. Y. N. H. & H.	29	928–931	30, 39, 91, 110, 122
†Persch, Frank		Engineer	Erie	19	1272–1273	164
Prickett, Walter	49	Engineer	B. & O.	28	504–509	12, 26, 73, 128
Proebstle, H.	45	Engineer	C. & N. W.	25	587–599	14, 27, 76, 105, 116, 129
Pugh, T. W.	60	Engineer	B. & O.	44	443–454	12, 25, 35, 71, 103, 115, 127
Pulliam, L. W.	58	Travel. Engr.	L. & N.	33	900–904	20, 29, 38, 90, 132
Raabe, A. J	48	Engineer	N. Y. C. & St. L.	29	842–843	19
†Rasmussen, S.	53	Engineer	C. & N. W.	31	632–635 655–656	14, 27, 78, 105, 129, 139
Ray, Geo. W.		Asst. M. Mech.	C. & A.		813	
†Rector, A. R.	33	Machinist	G. C. & S. F.	13	1155–1157	93, 157
Reddix, T. B.	35	Asst. M. Mech.	Wabash	20	877–887 1169–1177	88, 121
Richter, Ernest C	42	Engineer	C. & N. W.	22	560–574	26, 36, 75, 104, 116, 129
Rossiter, J. J.	62	Rd. Fore. Engines	N. Y. C. & St. L.	46	846–851	87, 120
Route, L. G.	53	Engineer	B. & O.	29	509–523	13, 26, 35, 73, 103, 116, 128
Rowe, H. A.		Engineer	Great North.	36	782–788	18, 28, 84, 108, 119, 131
Ruff, C. S.	46	Engineer	Penna.	25	805–806	85
Rust, W. K.	64	Engineer	Ill. Central	46	557–560	13, 26, 36, 75, 104, 116
Ryan, J. L.		Mech. Engineer	St. L. S. F.	20	612–619	76, 138
†Ryan, W. V.	38	Engineer	N. Y. C.	15	749–751	28, 107, 130, 147
Ryder, H. S.	56	Rd.Foreman Engs.	N. Y. O. & W.	36	716–718	16, 81, 107, 118, 130
†Sawyers, A. L.	30	Fireman	Ill. Central		672–673	80, 142

Name	Age	Occupation	Railroad	Years of Engine Service	Record	Abstract
Schaller, F.	49	Engineer	Penna.	31	794–800	18, 38, 85, 119
Schraffenger, R. C.	32	Fireman	B. & O.	8	496–503	12, 35, 73, 103, 115, 128, 136
†Shockley, A.	63	Hostler	C. B. & Q.	39	641–643	140
†Slosson, R. B.	59	Engineer	Nor. Pacific	32	753–766	17, 28, 83, 108, 119, 130, 147
†Smith, Willis		Engineer	A. T. & S. F.	5	1158–1159	158
†Snyder, Scott W.	46	Fireman	A. T. & S. F.		1136–1139	155
Spalding, W. N.	57	Engineer	N.Y. N.H.& H.	29	912–916	20, 29, 38, 90, 110, 121
Spikes, H. R.	56	Engineer	Ill. Central	33	670–672	27, 37, 106
†Stearns, Geo. E.	54	Engineer	Union Pacific	28	1095–1102	22, 30, 92, 122, 152
*W. B. Summers	50	Engineer	C. & N. W.	24	625–632	61, 77, 105, 117, 129
Sumner, Frank T.	43	Rd. Foreman Engs.	Nor. Southern	17	943	
Tesch, W. J.	46	Rd. Foreman Engs.	C. & E. I.	27	741–749	17, 37, 82, 107
Tewksbury, H. E.	46	Trav. Eg. & A. B. Insp.	B. & Aroostook	25	728–735	16, 28, 82, 118, 130
†Thorp, Charles S.	69	Engineer	C. & N. W.	51	574–578	14, 27, 36, 104, 129, 138
Traylor, Jesse	53	Travel. Engr.	L. & N.	32	887–897	19, 29, 38, 110, 121, 132, 150
Troutman, John	54	Engineer	Reading	21	862–863	88
†Truman, G. H.	73	Retired Engineer	Nor. Pacific	58	735–736	146
Vermeul, C. E.	43	Engineer	Penna.	21	800–802	28, 38, 85
†Waldrip, C. A.	62	Machinist	A. T. & S. F.	19	1154–1155	93, 157
†Wallace, Ira C.	60	Travel. Fireman	N. Y. O. & W.	39	715–716	146
Ward, James A.	54	Engineer	B. & O.	34	539–547	13, 26, 36, 74, 103
Ward, O. E.		Supt. M. P.	C. B. & Q.	29	1282–1290	96, 116, 125, 128, 134, 136
Warfel, Geo. H.	46	Asst. to Gen. Mgr.	Union Pacific		1107–1109	
Watt, T. W.		Engineer	C. & N. W.	20	681–683	80, 106, 130, 143
Wells, James F.	40	Machinists Helper	C. R. I. & P.	8	712–713	
Welsh, Pierce J.	65	Engineer	C. & N. W.	43	639–641	15, 129
Whetstone, Edw.	49	Engineer	Reading	29	856–860	19, 87, 109, 131
†Wilkins, Roy	49	Engineer	St. L. S. W.	30	718–719	81, 118, 130, 146
†Williams, H. L.	48	Road Foreman	C. & N. W.	24	673–681	37, 80, 118, 129, 142
†Wisham, C. M.		Engineer	A. T. & S. F.		1162–1163	159
Wood, A. E.	51	Travel. Engr.	L. & N.	30	905–912	20, 29, 38, 90, 132, 150

Total number of Respondents' Witnesses—172.
Number having Engine Service—136.
Number who gave their length of service—129.

IN THE

Supreme Court of the United States

OCTOBER TERM, 1934.

No. 221

UNITED STATES OF AMERICA, ET ALS.,
Appellants,

vs.

THE BALTIMORE AND OHIO RAILROAD COMPANY, ET AL.,
Appellees.

APPENDIX TO APPELLEES' BRIEF.

EVIDENCE.

I. STRENGTH REQUIRED TO OPREATE HAND REVERSE GEAR.

COMPLAINANTS' WITNESSES.

(a) In general.

(b) Under extraordinary conditions.

(1) Breaking in new locomotives just out of shop.

(2) Dry valves, etc.

STRENGTH REQUIRED.

FRANK STONE, age 56, years of service 30, C. & A. (a) Witness always able to handle lever by himself under all conditions, except as noted below (R. 242). Reversing the engine from forward to backward motion is a simple operation if standing with no steam (R. 240).

(2) Dry valves, improper lubrication or improperly fitted valve rings make reverse bar handle harder (R. 240). Admits, however, it is engineer's duty to look after lubrication (R. 245). In case the lever drops to the corner when traveling at speeds above 20 or 25 miles an hour with dry valves it would be impossible for one man to pull lever back to running position when water foaming, as that destroys lubrication (of the valves) causing lever to rattle. On such occasions *while working steam* it is necessary to get assistance of fireman, *or to reduce speed* (R. 241). But witness stated that this is not frequent (R. 248); and the engineer can immediately lubricate the valves to overcome such condition (R. 245). There are times when hand lever can be operated with no difficulty if no steam around the valve (R. 249).

W. A. GREENWOOD, age 60, years of service 45, D. & H. (a) No matter how easily it works, there is a lot of labor and hard work required to get it over (R. 261). Just as hard to operate hand lever on small engines as on the heavy type (R. 261).

(1) When they come out of shop with new bearings and tight fittings many times obliged to call on the brakeman and fireman to assist on the small engines (R. 261-2).

LE ROY STUCKEY, age 51, years of service 30, Pennsylvania. (1 and 2) Takes all you have got, and

sometimes strength of two or three. Fireman and brakeman assist at times. Cause of handling hard due to valve rings inserted too tightly, dry valve due to leaky pipe, bad water conditions, tight connections when locomotive just out of shop (R. 263-4).

C. B. IRWIN, age 58, years of service 32, Pennsylvania. (2) Both lever type and hand screw reverse very difficult to handle and requires considerable strength. Have had screw reverse gears when you could turn them with one hand, but sometimes after 4 or 5 hours wheel would become so difficult you have all you can do to get it over with both hands (R. 266-7). Cause of screw reverse operating with difficulty due to thread on screw being heavy, stating that it was his opinion the large thread would be harder to turn than the small thread (R. 267).

RAY M. DILLER, age 51, years of service 30, Pennsylvania. (1 and 2) Witness stated strength required is oftentimes more than he has. Unable to handle lever in all cases due to a sustained injury to his back, and has to have assistance of fireman (R. 271). Witness stated hand lever was difficult to operate on all classes of engines due to reverse bar binding on quadrant; engine out of shop with tight boxes; not getting enough oil; engine foaming, or leaky dry pipe (R. 272).

FRANK HURD, years of service 30, Erie. (1 and 2) The hand operated screw reverses in the best of condition work plenty hard (R. 274). Hand operated lever on H-21 Class, Consolidated, some work easy and some work hard, the causes being the valves are blown, engine out of shop, tumbling shaft boxes up snug, bind a little on quadrant, dog tight in latch, tight latch spring (R. 275). Witness stated you have air to help you with one, and the other manual strength (R. 275).

MATTHAIS GINDER, age 63, years of service 34, Erie. (1 and 2) Witness stated the hand reverse lever at times will work hard, and other times will not; the cause of this difficulty being due to water over the valves, bearings getting dry and worn, there being about 17 bearings, pins and all (R. 277). The dry bearings situation could be corrected by oiling them, agreed the witness, but stated there were a lot of times you didn't have time to do that (R. 278). He had had only limited experience with hand lever equipment and only an occasional trip in recent years. Nearly all of the hand reversed engines he referred to are out of service now (R. 277-8). As fireman he did not assist the engineer to throw the lever (R. 278). Not very much difference in handling engine weighing 100,000 pounds on drivers and those weighing up to 240,000 pounds (R. 276-7).

W. T. LAWRENCE, age 71, years of service 40, Erie. (2) On the Consolidated engines, the H-21s, almost impossible to reverse them if engine just out of shop. Oftentimes had to call on fireman to help (R. 281-2). Some of the hand reverse engines handle much easier than others (R. 281).

LINCOLN G. TANNER, age 49, years of service 27, Boston & Maine. (2) On Pacific type hard thing to do to hook up some of them (R. 285). Oftentimes requires assistance of fireman to reverse engine with steam in cylinders (R. 286). Same difficulty exists on smaller class of engines with respect to handling the lever (R. 286). Witness' opinion that after 8 hours with hand reverse arms and shoulders would be lame. Had to have assistance of extra man when they first obtained the six-wheel switcher with Baker gear (R. 287). But

extra man used only while engine new and being broken in (R. 287).

JAMES BROWN, years of service 38, N. Y. C. (2) If valves are dry and rings are worn, and just out of shop, they handle hard. But Management is very good in doing what it can about remedying this to help us and make them handle well. When engine just out of shop we have to have assistance of fireman (R. 290).

PATRICK FLOOD, age 51, years of service 29, N. Y. C. (a) Using 4-6-2 type of locomotive weighing around 170,000 pounds on drivers, witness stated takes a lot of weight to pull one back (R. 293). He stated he could handle hand reverse gear all right except when reversing (R. 294).

B. A. SNODDY, age 53, years of service 24, C. C. C. & St. L. (a) On the 2-8-2 type witness stated that sometimes the hand reverse can be operated without much effort; other times it requires assistance of fireman (R. 296). The Atlantic type would sometimes work handily, and other times took two to reverse it (R. 297). In yard service covering a trick of 14 to 16 hours, witness sometimes has occasion to call on fireman for assistance (R. 297).

ELMER T. HAIRE, age 49, years of service 29, Mich. Central. (2) On Consolidated class weighing 215,000 pounds takes a lot of strength under certain conditions, such as ice and snow, and under other conditions it does not take so much. The main cause of working hard is due to link motion or links and link block being frozen and full of ice and snow (R. 302). The same is true with respect to the 0-6-0 type (R. 303).

W. B. SOUTHARD, age 52, years of service 25, Mich. Cent. (a) With reference to 2-8-0 type, some of them

are practically easy and some of them are very hard (R. 305).

J. R. PRICE, age 55, years of service 28, C. & O. (a) Lever on G-9 engines, 178,400 pounds, Consolidated, handle pretty hard. I always have to get up to reverse, but probably a lot of them could reverse sitting down. The G-7s, Consolidated, 164,000 pounds, do not handle so hard (R. 308).

A. K. PEARCE, age 41, years of service 20, Seaboard Air Line. (1) In the 700 Class, the L-2, 4-6-0, 132,610 pounds occasionally they work hard, and then they work light as the engine wears some or gets properly broken in (R. 311). Works hard on occasions when the oil gets away from the valve, or the valve becomes dry, and perhaps tight bearings (R. 311). Engines just out of shop obliged to have assistance of fireman or helper to break them in (R. 312). This witness indicated how he usually operated the hand reverse lever while remaining seated, but stated he usually stood up to pull the lever over from rear to front. In reversing from front to rear he usually puts his foot on the boiler-head, remaining seated. He couldn't say whether a foot-brace was provided or not. There is plenty of room for him to turn sideways on his seat box (R. 312-3).

OWEN HOWARD, age 53, years of service 32, B. & O. (2) Strength required varies, sometimes hard to handle depending upon weather and other conditions, and sometimes handle so that you can pull them over. When handling hard I have assistance of fireman (R. 317).

J. H. AUSTIN, age 52, years of service 29, S. & A. (a) The heaviest engines on his railroad, 130,000 pounds, witness stated it takes about all you have got sometimes, and sometimes it might not be so hard as at

other times (R. 321). On the 105,000 pound engines, they handle pretty easily but sometimes they handle hard (R. 321).

H. G. WILLIAMS, age 55, years of service 28, C. & N. W. (a) The M's and M-1's, Stephenson gear, handled fairly well after broken in. With the Baker gear they handle hard. Certain points with Baker gear that are easy even with new engine. Cause of difficulty in getting them over was change of angularity of the gear (R. 328). Witness stated that a number of the M's and M-1's have been scrapped in recent years and retired from service (R. 333). If the hand reverse is working easy you can throw it over as quickly as you can the power (R. 330). Witness and all engineers he has observed operate hand lever on Class Z engines (214,000 pounds on drivers) while sitting on seat-box (R. 332).

ARTHUR R. DOMINI, age 45, years of service 19, C. & N. W. (a) On the 4-6-0 type, 140,000 pounds, and the 0-6-0 type, 130,000 pounds, requires all of engineer's strength most of the time on road engines. Can get the yard engines over a little easier (R. 334).

ARTHUR R. RUDOLPH, years of service 28, C. & N. W. (a and 1) Some instances they handle very nicely and no objection at all; other times takes all strength you have and then ask fireman to assist (R. 337). When engine works water the lubrication washes off from the valves and makes engine work hard (R. 337). The lubrication freezes in cold weather (R. 338).

L. J. LARSEN, age 48, years of service 27, C. & N. W. (a, 1 and 2) Varies as to type of valve gear and condition of reversing gear and weather conditions. R-1 engines work with less effort than any other type. Classes D, E and E-1's more difficult (R. 343-4). The cause is

usually due to engine just out of shop and water happens to be thrown into the valves; or leaky dry pipe, or oil congealing in the bearings of the gear (R. 344). The matter of water getting into the valves and the leaky pipe are rare occurrences (R. 346).

Wm. H. Stringer, years of service 21, C. & N. W. (2) It takes considerable strength to operate a manual reverse lever. Cause could be due to worn parts of machinery, dry valves, poor spring in reverse lever latch, worn teeth in quadrant (R. 347). In winter time hard to handle with oil in links cold and stiff (R. 348). Witness stated that loose spring or worn teeth in quadrant will not make handle throw harder (R. 349).

A. C. Rasmussen, years of service 21, C. & N. W. (a, 1 and 2) Some require all strength you have, and others handle fairly easy. The cause of this due to engines out of shop, when they are tight. Sometimes lost motion gives it a chance to vibrate (R. 349). In ordinary run of work after they are worn down and weather conditions favorable, witness handles hand levers without any particular difficulty. Handle hard in extremely cold weather, say 10 above zero to 30 below. Foaming water causes lever to handle hard and this occurs about once a week (R. 351).

J. R. Adams, years of service 24, Wabash. (1 and 2) In starting train takes all you have, and sometimes have assistance of fireman. Switch engines as a rule work reasonably well, seldom having one that is unreasonable to work. Coming out of the shop they are naturally tight for 3 or 4 days. Caused from a pull on the valves; most frequently because of dry valves (R. 353).

Bert Underwood, age 44, years of service 21, Wabash. (a, 1 and 2) Engines new out of shop you exert

every ounce of strength. Those not new and well lubricated handle pretty good. In some cases can break them in in 4 or 5 days. Cause of difficulty weak counterbalance springs, improperly adjusted counterbalance springs, tight bearings and dry valves (R. 358).

Wm. A. Garman, age 54, years of service 29, St. L. S. F. (a) Generally has to brace himself, and in freight service sometimes has had assistance of fireman, but never in passenger service (R. 362).

J. M. Crum, age 62, years of service 34, C. B. & Q. (a and 2) Strength depends on condition of valves and joints in valve gear. Some handle hard, and some handle comparatively easy. New valve rings and foaming of water contribute to make engine handle harder (R. 365-6).

J. J. Rogers, years of service 26, C. B. & Q. (a, 1 and 2) Under normal conditions requires considerable amount of strength (R. 368). Causes of lever working hard due to engines out of shop, tight bushings and links, new valve bushings, reach rod binding on brackets and weather conditions, such as dust storms (R. 369).

Otto Inglett, age 57, years of service 28, A. T. & S. F. (a and 2) The 1200 compounds are very hard to reverse. At times the others are hard. The piston valves sometimes are hard when the valve is full of steam (R. 373).

E. L. Barton, age 47, years of service 30, Nor. Pacific. (a and 2) Some are hard, medium, and some of them easy. Those that are hard require considerable strength to reverse, especially those out of shop. Others, however, handle fairly easy. Dry or worn valves, worn reverse lever latch and cold weather cause lever to work hard (R. 375). It is customary to remain seated in reversing the engine in switching ahead (R. 378) and in "hooking up" in transfer service (R. 375).

C. B. KINNAIRD, age 64, years of service 41, L. & N. (a) Witness states requires all your strength on passenger runs. There is not much difference in any of them (R. 386). Witness admits that the hard working of the gear is only in exceptional cases (R. 388).

JAKE PASCHALL, age 33, years of service 13, L. & N. (a) With the average, a man can brace his foot and take both hands and throw it over all right. We have some that handle harder and require more strength (R. 390).

H. C. GANS, age 52, years of service 28, L. & N. (a) Strength required depends on the engine. Sometimes you cannot do it by yourself (R. 393). Before witness injured his knee (bumping it in climbing on an engine) he operated lever without assistance, and states he does it now; although the boys all know he has a bad knee and they move the lever for him if it works hard (R. 395).

J. M. DIXON, years of service 29, L. & N. (a and 2) In reversing the hand lever, under ordinary conditions handles fairly well; but it requires most of your strength to handle under extraordinary conditions such as trapped steam in cylinder and steam chest, adjustment of counterbalance spring, dry valves, poor lubrication, tight connections and rocker boxes (R. 397).

J. B. POOL, age 58, years of service 25, C. R. I. & P. (a and 2) Some engines can be reversed easily, and others take all the strength you have, and sometimes require assistance of the fireman (R. 401). On one occasion witness had engine with leaky dry pipe and after it was remedied the lever worked easier (R. 403-4).

EARL WALKER, age 39, years of service 18, C. R. I. & P. (2) Under a good many conditions the lever handles very hard. In the winter time, the lever handles harder

on account of the oil being cold, the oil in the bearings, the valve motion. This situation occurs when temperature is from freezing on down. Causes of lever working hard under other conditions due to improperly adjusted counterbalance spring and dry valves (R. 410).

NICK W. BRANDT, years of service 16, C. & W. I. (2) A majority of the time in passenger switching it takes all the strength you have Stiff handling of lever usually due to steam in valves, dry valves, leaky dry pipes, oil holes frozen in winter time, and oil holes stopped up with dirt (R. 416). Witness stated the hand lever works hard because of the steam in the valves. He admitted cylinder cocks could be installed so as to direct steam downward and underneath the locomotive so steam could not possibly be blown on men around locomotive; also that the control of cylinder cock could be placed conveniently for engineer's operation (R. 420).

I. STRENGTH REQUIRED TO OPERATE HAND REVERSE GEAR.

RESPONDENTS' WITNESSES.

(a) In general.

(b) Under extraordinary conditions.

(1) Breaking in new locomotives just out of shop.

(2) Dry valves, etc.

STRENGTH REQUIRED.

J. E. GELDBAUGH, age 55, years of service 36, B. & O. (a) When properly lubricated and equalized, always able to handle it, and never physically exhausted (R. 425).

(1) Sometime ago, locomotives just released from shop because parts were new, would work little hard, but these engines now broken in by man other than engineer (R. 426).

(2) If valve gets dry would require more strength. But dry valves are rare cases due to automatic lubricators (R. 439).

T. W. PUGH, age 60, years of service 44, B. & O. (a) Always able to handle them without any trouble (R. 445).

(2) A dry valve makes gear motion rough, and lowering the lever toward corner you would find a pull (R. 448). Has always been able to lubricate engine while running (R. 452).

JUNIOR B. FRALEY, age 46, years of service 21, B. & O. (a) On special engine witness had been running for sometime, manual lever worked 100 per cent. Also on other engine lever worked 100 per cent and others did not, but no variation in strength (R. 466).

(1) On one occasion manual gear worked hard because engine just out of shop and parts were new (R. 468).

ROY FRALEY, age 52, years of service 35, B. & O. (a) Never got one yet that he could not reverse (R. 471).

R. BROTHERTON, age 49, years of service 32, B. & O. (a) Has experienced no trouble handling them (R. 482).

(1) New engine out of shop naturally harder to handle than one which has been run a while (R. 487).

(2) Dry valves produce friction and wash off lubrication, but condition of that kind would be neglect on part of engineer (R. 491).

R. C. SCHRAFFENGER, age 32, years of service 8, B. & O. (a) Has been able to handle hand lever on any engine he has ever had (R. 498).

WALTER PRICKETT, age 49, years of service 28, B. & O. (a) Engine properly equipped, no defects, and in service a while, never found it a hardship, nor any exertion (R. 504).

(1) Engine just out of shop may experience little trouble (R. 504).

L. G. Route, age 53, years of service 29, B. & O. (a) Times when he would use little more strength than ordinarily, due to condition unnoticed or something getting dry (R. 510).

(1) Engines out of shop generally little stiffer than others (R. 516).

James A. Ward, age 54, years of service 34, B. & O. (a) If properly maintained, no great physical exertion attached to it, and hard operation is an exception to ease of operation (R. 540).

Daniel F. Crowley, age 68, years of service 41, Illinois Central. (a) Some handle easier than others, but none that I couldn't get back and forth nicely without strain of any kind (R. 548).

Miles Crystal, age 39, years of service 19, Illinois Cent. (a) At times he uses one hand at times two hands (R. 550).

C. P. McCaskill, age 56, years of service 32, Illinois Cent. (a) Has never had any difficulty (R. 553).

(1) When first out of shop they are hard to handle; they are stiff, and we get them lubricated and thoroughly broken in for service. During this period no serious difficulty is experienced with the manual reverse (R. 553-4).

G. C. Buell, age 67, years of service 44, Illinois Cent. (a) No trouble at all reversing engine (R. 555).

W. K. Rust, age 64, years of service 46, Illinois Cent. (a) Never had any trouble (R. 557).

(2) Occasionally lever was stiff due to dry valves (R. 560).

CHARLES S. THORP, age 69, years of service 51, C. & N. W. (a) Speaking of 120,000 pound engines, witness has never been abused as result of handling them (R. 578).

(2) Little more pull on lever when valves are dry, but nothing out of ordinary (R. 577).

H. HERRICK, years of service 30, C. & N. W. (a) Has pulled just as hard on power reverse as manual (R. 583).

(2) Dry valves cause little more pull on lever (R. 586).

H. PROEBSTLE, age 45, years of service 25, C. & N. W. (a) Never saw one yet he couldn't get over without assistance. As a general rule, I tip them over with one hand and at times with two hands, depending upon whether sitting down or standing up (R. 588).

FRANK ELLIS, years of service 35, St. L. S. F. (2) Cases of dry valves or cylinder, there would be a hard pull on the lever, but these cases extremely rare, but not so hard to handle (R. 611).

A. OLSEN, age 51, years of service 28, C. & N. W. (a) Never had any trouble with them (R. 619).

(1) Sometimes out of shop link block pretty snug, but after 8 hours' running they are broken in fairly well (R. 619).

S. RASMUSSEN, age 53, years of service 31, C. & N. W. (a) When running his own engine, he can do most anything he cares to, because he figures more on the levers of his own engines than when he gets someone else's (R. 633).

F. C. MEYER, age 56, years of service 39, C. & N. W. (a) Never experiences any trouble (R. 638). Five years ago, while reaching for frog to place in front of wheel on car off the track witness received rupture and has had no effect on handling manual lever (R. 638).

PIERCE J. WELSH, age 65, years of service 43, C. & N. W. (a) Has always been able to handle them without exerting himself in any manner (R. 640).

(1) Has had considerable experience breaking in engines and has always been able to handle them alone (R. 640).

J. R. FIELDS, age 56, years of service 40, Ill. Cent. (a) Has found nothing hard about manual reverse in any way (R. 666). Since operating hand gear has put on 40 pounds, feels fine at night, and attends dances, parties, etc., whereas with power reversed engines he doesn't feel so well after a day's work (R. 667).

W. J. DOOLITTLE, age 53, years of service 32, Ill. Cent. (a) Never strained, overtaxed or exhausted himself (R. 668).

S. J. BUCKNER, age 54, years of service 27, Ill. Cent. (1) Has experienced a little difficulty breaking in engines, but same amount of strength required on power reverse (R. 669).

T. W. WATT, years of service 20, C. & N. W. (a) Requires more strength to operate engine weighing 200,000 pounds or over than one weighing under 100,000 pounds (R. 683). Does not have to exert himself; it is just a matter of handling the engine and "I never noticed that it bothered me in anyway" (R. 683).

(1) Engine brand new, everything being tight, naturally causes lever to work little harder (R. 683).

(2) Dry valves and counterbalance spring sometimes out of adjustment will cause lever to work little hard (R. 683).

E. G. BATES, age 64, years of service 44, C. & N. W. (a) Never failed to be able to get them over and has never strained or overtaxed him (R. 684).

C. W. Burkhalter, age 57, years of service 35, C. B. & Q. (a) Has never had any trouble with them outside of breaking in a new engine (R. 691).

F. W. Heck, age 44, years of service 26, Ill. Cent. (a) Witness could not recall that it required any special effort (R. 696).

Geo. E. Loshbaugh, age 55, years of service 34, Union Pacific. (a) The lever handles easy on all occasions and has no trouble with it (R. 699).

(1) Engine out of shop witness uses both hands because everything is new and tight (R. 699).

W. S. Beach, age 54, years of service 40, Union Pacific. (a) Never had to have any help (R. 700).

(1) Engines new out of shop hard to handle until broken in (R. 700-1).

(2) Some difficulty in handling lever when valves are dry (R. 700).

H. S. Ryder, age 56, years of service 36, N. Y. O. & W. (1 and 2) Breaking in engines new out of shop witness uses both hands, otherwise one hand (R. 716-7).

W. G. Knight, Mech. Supt., years of service 30, B. & Ar. (a) Having ridden 50,000 miles on the 26 hand reversed engines on his line, witness stated he never found the slightest difficulty in operation of lever, it being seldom necessary for engineer to use two hands (R. 720-1).

(2) In cases of dry valves, lever operates harder than normally (R. 723).

J. H. Curtis, Div. Supt., years of service 30, B. & Ar. (a) From his observation, engineers never have to exert themselves to any great extent (R. 725).

H. E. Tewksbury, Travel. Engr. and Air Brake In-

spector, age 46, years of service 25, B. & Ar. (a) Never at any time overexerted himself. In observing engineers, they never appeared as though it were hard for them (R. 729).

(2) Get a heavier pull when valves are dry (R. 733).

W. J. Tesch, age 46, years of service 27, C. & E. I. (a) Have handled engines weighing from 66,000 to 220,000 pounds on drivers, with hand reverse gears and never experienced any difficulty (R. 742). With respect to engines equipped with Alco gear and friction blocks, power reverse lever handles harder than hand lever; it takes two hands to handle those levers (R. 744).

M. G. Love, age 53, years of service 32, Nor. Pacific. (1 and 2) Manual lever handles harder when valves are dry and engine new out of shop; there is a tendency for the lever to pull away from the engineer, but I never had it do so (R. 752).

R. B. Slosson, age 59, years of service 32, Nor. Pacific. (a) No exertion that was ever injurious in any way, shape or form with the hand lever; but Precision power reverse frequently required more effort to reverse than hand lever (R. 754-5).

(1) In breaking in engines never, at any time, had to have assistance (R. 755).

Edwin C. Coyle, age 47, years of service 27, Northern Pacific. (a) Never bothered him and never had to call on any one to assist him (R. 767).

(2) Dry valves and tight bearings cause lever to handle harder (R. 769).

Geo. W. Johnson, age 56, years of service 36, Northern Pacific. (a) Just ordinary strength required (R. 772).

H. Hoeft, age 45, years of service 27, Great Northern.

(a) Never exerted himself to any extent (R. 775). In fact, handled two trips over 100 miles each with broken counterbalance spring and experienced no physical effect; had engine weighing 184,000 pounds, on drivers; it was a 16-hour job (R. 776).

H. A. Rowe, years of service 36, Great Northern. (a) Nothing more than the ordinary (R. 783).

(b) In extremely cold weather and engine is new they work more or less stiff, but never overexerted himself (R. 783).

(2) If valves become dry would handle harder than after engine was properly lubricated (R. 786).

Frank O'Neill, age 49, years of service 31. Great Northern. (a) Never overexerted himself (R. 789).

F. Schaller, age 49, years of service 31, Pennsylvania. (1) Engines out of shop work a little hard (R. 794).

J. H. Haine, age 58, years of service 33, Pennsylvania. (a) Not any particular difficulty (R. 802).

(1) Little hard sometimes when engine just out of shop (R. 802).

J. C. Harris, age 64, years of service 48, T. & N. O. (a) Never noticed any great amount of strength was required (R. 820).

(2) Have little trouble with dry valves (R. 820).

A. J. Costley, age 46, years of service 28, T. & N. O. (a) Recalls no instance where he has ever overexerted himself (R. 832).

E. E. LaPage, age 59, years of service 39, C. St. P. M. & O. (a) Never overexerted himself (R. 834).

J. F. Flynn, years of service 29, C. St. P. M. & O. (a) Has never at any time overexerted himself (R. 840).

F. C. Cooper, age 55, years of service 25, N. Y. C. & St. L. (a) Has always been able to handle it in proper manner (R. 841).

A. J. Raabe, age 48, years of service 29, N. Y. C. & St. L. (a) Never had any trouble; as general rule they handle very good (R. 843).

(1) Occasionally one coming from the shop will handle hard for a day or so (R. 843).

Harry J. Dampman, age 55, years of service 42, Reading. (a) Never had any difficulty (R. 852).

(1) Engines out of shop until well lubricated handle a little hard and require two hands (R. 852).

Edward Whetstone, age 49, years of service 29, Reading. (1) A new engine, as a general thing, works a little stiff account of new bearings (R. 856).

Thomas Horan, age 47, years of service 25, Reading. (a) Never had any trouble operating manual reverse (R. 860).

Charles E. Beecher, age 43, years of service 20, Reading. (1) Engine out of shop naturally a little tight and stiff and requires a little more effort, but you would not call it any trouble (R. 863).

H. L. Cosper, Rd. Foreman of Engines, age 44, years of service 24, Wabash. (a) Does not require any great effort to handle and are apparently easy (R. 865).

(2) In cases of dry valves, you use a little more strength (R. 866).

Jesse Traylor, Traveling Engr., age 53, years of service 32, L. & N. (1) An engine out of shop will work a little hard the first round trip (R. 893).

O. G. McPhail, Fuel Supervisor, age 57, L. & N. (1

and 2) Engines just out of shop and those with dry valves, lever handles a little harder (R. 898).

L. W. Pulliam, Travel. Engr., age 58, years of service 33, L. & N. (1) Only in cases of engines out of shop is it necessary to have assistance in operating manual gear, and this for but one break-in trip, this being due to parts put up snug and not lubricated (R. 901).

A. E. Wood, Travel. Engr., age 51, years of service 30, L. & N. (1) Only difficulty was breaking in engine out of shop and this only during one break-in trip (R. 905).

W. N. Spaulding, age 57, years of service 29, N. Y. N. H. & H. (a) Has never yet seen the time when he could not handle the hand reverse lever (R. 913). Not much difference in strength required to operate either gear (R. 916).

(1) Engines just out of shop will handle harder (R. 915).

J. J. Fitzgerald, age 45, years of service 29, N. Y. N. H. & H. (a) Never had to use any great amount of strength, and never overexerted himself (R. 917).

James F. Jones, age 55, years of service 31, N. Y. N. H. & H. (a) Cannot recall any hard experience and never overexerted himself (R. 920).

(1) Engines out of shop a little stiff, but this condition soon eliminated after putting them on the "slip" track (track oiled for this purpose) (R. 920-1).

Edward Landers, age 54, years of service 33, N. Y. N. H. & H. (a) Requires very little strength. Never at any time overexerted himself (R. 927).

A. C. Adams, Supt. M. P., age 65, years of service 47, Nor. Southern. (a) Man of ordinary strength can operate it easily (R. 933).

(1) Engine out of shop with fittings tight would handle harder than normally (R. 937).

(2) Harder to handle when valve gear valves are dry, and this is true also of power reverse (R. 933).

HOWARD BOBBITT, Road Foreman of Engines, age 55, years of service 39, Nor. Southern. (a) Can handle them with one hand without any inconvenience (R. 938).

(1) Little hard when engine just out of shop and breaking it in (R. 941).

(2) Dry valves require a little more effort (R. 939).

J. H. BARKER, age 42, years of service 24, Western Md. (a) Finds it very easy to handle (R. 947).

WALTER E. BUTLER, age 47, years of service 31, Western Md. (a) Has no difficulty whatsoever (R. 949).

(1) Engine new out of shop works a little tight (R. 954).

(2) A little more effort due to dry valves (R. 954).

J. H. DALZELL, age 45, years of service 26, Union Pacific. (a) The Precision gear works pretty stiff sometimes and is harder to operate than any of them—hand or power (R. 1093). Some of them you can hardly move when just out of shop because gear is put up too snug (R. 1093).

(1) Only on one occasion when breaking in new engine out of shop was witness unable to operate hand reverse lever, and when a half mile out had switch engine take him back to roundhouse (R. 1088).

(2) Working in water, dry valves and steam in the cylinders will cause reverse lever to work a little hard (R. 1093).

GEORGE E. STEARNS, age 54, years of service 28, Union Pacific. (a) Strength required to handle hand reverse and power reverse about the same; not much strength required for either one. Some of the power reversed engines work pretty stiff (R. 1101).

W. H. BAILEY, age 58, years of service 27, Union Pacific. (a) Neither one of the reverse gears, *i. e.*, hand and power, unduly fatigues him, witness stated (R. 1103).

J. W. BURNETT, Asst. Gen. Supt. M. P. & M., age 41, years of service 25, Union Pacific. (a) Witness stated from his observation and experience in connection with hand reverse gear there has never been any hardship on the engineman in any way (R. 1135).

E. VON BERGEN, Genl. Air Brake Engineer, years of service 30, Illinois Central. (a) During his 21 years' experience in handling manual reverse levers witness stated a hard handling reverse gear was an infrequent occurrence. During these years it was never necessary at any time to call for assistance (R. 1180).

J. E. BJORKHOLM, Asst. Supt. M. P., C. M. St. P. & P. (a) Witness stated that while there may be circumstances that may cause some individual lever to move hard, as a general rule he has not found any difficulties in handling the manually operated lever (R. 1195).

E. B. HALL, Gen. Supt. M. P. & M., years of service 42, Chicago & North Western. (a) In general, witness used one hand. On infrequent occasions through lack of proper lubrication of the valves or binding of working parts the lever handled harder than ordinarily, and witness used both hands (R. 1211).

E. R. GORMAN, Supt. M. P. & M., years of service 30, C. St. P. M. & O. (a) During the period 1913 to 1915, when witness handled locomotives almost daily, he never

found one engine that required strenuous or unusual manual effort to operate (R. 1247).

(2) Had no recollection of ever experiencing any difficulty when there was any degree of dryness in the valves (R. 1278).

A. B. Ford, Master Mechanic, years of service 36, Great Northern. (a) Witness stated "I cannot recall operating any engine or engines that tested my strength or in any manner gave me unusual exertion" (R. 1302). Further stated that his principal work as an engineer was in mountain work and he experienced no danger to himself and involved no unusual physical effort on his part (R. 1302).

Frederick Kerby, Asst. to Chf. of M. P., years of service 51, Baltimore & Ohio. (a) Witness stated in his entire experience he never found a manual reverse gear that he could not operate with very little physical effort (R. 1308).

W. P. Harris, age 54, years of service 33, Norfolk & Western. (a) Never had any difficulty with manually operated reverse gears (R. 1315).

II. Physical Effect Upon Enginemen.

COMPLAINANTS' WITNESSES.

Physical Effect.

Ray M. Diller, age 51, years of service 30, Pennsylvania. It plays me out. Evidently because of prior injury (R. 271).

Lincoln G. Tanner, age 49, years of service 27, Boston & Maine. Has run engines with hand reverse for eight hours, and when he got through his arms and shoulder were pretty lame (R. 287).

James Brown, years of service 38, N. Y. Central. On local freight, picking up and setting out cars, if you get a hard engine to handle you are pretty tired after working 12 to 13 hours (R. 290).

B. A. Snoddy, age 53, years of service 24, C. C. C. & St. L. On a trick of 14 to 16 hours you get pretty tired before you are through (R. 297).

J. R. Price, age 55, years of service 28, C. & O. It doesn't take half the power to pull a power reverse over that it does with the manual (R. 309).

Arthur R. Domini, age 45, years of service 19, C. & N. W. Requires all the strength a person can stand for a day's work (R. 334).

L. J. Larsen, age 48, years of service 27, C. & N. W. Over eight hour period has a tendency to cause you to become tired and possibility of being less alert (R. 344-5). On cross-examination, witness stated he never had an accident which he could attribute to his being tired or less alert (R. 347).

WM. H. STRINGER, years of service 21, C. & N. W. When raising lever out of corner it puts a strain on his back (R. 347).

J. R. ADAMS, years of service 24, Wabash. In hooking up the lever it is pretty annoying and tiresome lots of times (R. 353).

BERT UNDERWOOD, age 44, years of service 21, Wabash. Toward the end of a day's work you are getting pretty slow and tired (R. 359).

NICK W. BRANDT, years of service 16, C. & W. I. After about six hours' operation on that lever witness stated he was just about half played out (R. 416).

RESPONDENTS' WITNESSES.

J. E. GELDBAUGH, age 55, years of service 36, B. & O. Always equal to the occasion, and always able to handle them (R. 425).

T. W. PUGH, age 60, years of service 44, B. & O. Never overstrained or overtaxed himself (R. 445).

R. BROTHERTON, age 49, years of service 32, B. & O. Never has felt strain, even when handling lever frequently. Has never affected him physically (R. 482-3). Has always felt all right after a day's work with one of them (R. 486). Never had a tired back from handling lever over a day's work (R. 488). In 1920, witness, who weighs 155 pounds, purchased 10 acres in the country, rebuilding house, building barn, garage, several large chicken houses and planted an orchard of 500 trees. This was all done after working regular hours as an engineman; and during the years when the heaviest part of this work was being done, he used hand reverse gears 100 per cent (R. 482-3).

WALTER PRICKETT, age 49, years of service 28, B. & O. Never had to use energy enough so as to injure himself (R. 507).

L. G. ROUTE, age 53, years of service 29, B. & O. Neither one of the hand gears causes any unusual or undue physical strain (R. 510).

B. F. FREELAND, age 59, years of service 33, B. & O. Never experienced any difficulty, nor has never been exhausted at end of day's work (R. 521).

JAMES A. WARD, age 54, years of service 34, B. & O. Physical condition always such after a day's work that he could go fishing, gunning or play ball (R. 542).

DANIEL F. CROWLEY, age 68, years of service 41, Ill. Central. Never strained, overtaxed or exhausted himself by reason of operating hand reverse gear (R. 541).

MILES CRYSTAL, age 39, years of service 19, Ill. Central. Never strained or overtaxed himself or exhausted after a day's work (R. 550).

C. P. MCCASKILL, age 56, years of service 32, Ill. Central. Handling of manual gear has never caused any strain (R. 553).

G. C. BUELL, age 67, years of service 44, Ill. Central. Never strained, overtaxed or exhausted himself operating manual gear (R. 554). After day's work with power reverse witness has pains in his shoulder and back of his neck (R. 555).

W. K. RUST, age 64, years of service 46, Ill. Central. Never strained or overtaxed himself (R. 557).

ERNEST C. RICHTER, age 42, years of service 22, C. & N. W. Hand lever has no effect upon him (R. 561).

CHARLES S. THORP, age 69, years of service 51, C. & N. W. No effect whatsoever in his physical condition. Further stated if he had to handle the M-2s and M-3 type with power reverse in switching service he would be more tired because sitting in that position would cause a twist in the shoulder and neck (R. 575-6).

H. PROEBSTLE, age 45, years of service 25, C. & N. W. Witness never noticed any physical effect (R. 589). After a day's work with hand reverse witness could go fishing or hunting, whereas with power reverse on the M-3 his arm would get tired and played out (R. 593).

S. RASMUSSEN, age 53, years of service 31, C. & N. W. Never experienced any undue physical strain (R. 633).

F. C. MEYER, age 56, years of service 39, C. & N. W. Never worked in such a way to overstrain or overtax himself (R. 638), notwithstanding he has worked for past 5 years with a rupture which resulted from other causes (R. 638).

O. B. LINDQUIST, age 51, years of service 29, C. & N. W. Witness never experienced any undue exertion (R. 649).

J. R. FIELDS, age 56, years of service 40, Ill. Central. Never strained or overtaxed himself (R. 666). Feels better physically when operating with hand levers than when using power reverse, after a day's work (R. 667).

W. J. DOOLITTLE, age 53, years of service 32, Ill. Central. Feels all right at end of day's work; in fact, the same as with power reverse (R. 668).

S. J. BUCKNER, age 54, years of service 27, Ill. Central. Never strained, overtaxed or exhausted himself (R. 669).

H. R. SPIKES, age 56, years of service 33, Ill. Central. Never strained, overtaxed or exhausted himself (R. 671).

E. G. Bates, age 64, years of service 44, C. & N. W. Never strained or overtaxed witness in any way (R. 684).

F. W. Heck, age 44, years of service 26, Ill. Central. Never exhausted or strained as result of operating manual reverse (R. 695).

W. S. Beach, age 54, years of service 40, Un. Pacific. Condition at end of day's work always normal (R. 700).

H. E. Tewksbury, age 46, years of service 25, B. & Ar. Has been more exhausted at end of a day's work as result of operating power reverse than hand reverse (R. 729).

W. V. Ryan, age 38, years of service 15, N. Y. C. Never overexerted himself (R. 749).

R. B. Slosson, age 59, years of service 32, Nor. Pacific. Never felt fatigued with hand reverse, but has with power reverse; witness has been obliged to visit an osteopath for treatments due to operating precision power reverse causing strain on the arm (R. 755).

H. A. Rowe, years of service 36, Grt. Northern. Never noticed any difference, physically, at end of day's work between manual and power reverse (R. 783).

Frank O'Neill, age 49, years of service 31, Grt. Northern. No physical effect whatever (R. 789).

C. E. Vermeul, age 43, years of service 21, Pennsylvania. Has never been overtired or fatigued at end of day's work; in fact, attends twilight ball games frequently (R. 800).

G. E. Hert, age 47, years of service 22, Pennsylvania. Never physically exhausted or tired out (R. 807).

B. B. Cooksey, age 48, years of service 24, Sou. Pacific. Has never become overtired or overtaxed (R. 814).

J. C. HARRIS, age 64, years of service 48, T. & N. O. Never experienced any physical effect due to handling manual reverse (R. 820-1).

A. J. COSTLEY, age 46, years of service 28, T. & N. O. Has felt no effect physically in any way (R. 832).

E. E. LAPAGE, age 59, years of service 39, C. St. P. M. & O. Never felt any effect upon him (R. 834).

J. F. FLYNN, years of service 29, C. St. P. M. & O. Never at any time experienced any adverse physical effect (R. 840).

F. C. COOPER, age 55, years of service 25, N. Y. C. & St. L. Never overexerted himself (R. 841).

THOMAS HORAN, age 47, years of service 25, Reading. Always felt better at end of day's work after handling manual reverse than he did with power reverse (R. 860).

JESSE TRAYLOR, age 53, years of service 32, L. & N. Physical condition at end of day's work was always good (R. 888).

L. W. PULLIAM, Travel. Engr., age 58, years of service 33, L. & N. Has never been in an exhausted condition after a day's work (R. 902).

A. E. WOOD, Travel. Engr., age 51, years of service 30, L. & N. Physical condition at end of day's work the same whether operating manual or power reverse gear (R. 905-6).

W. N. SPAULDING, age 57, years of service 29, N. Y. N. H. & H. Never had any effect. States he feels much better as result of operating hand reverse than he does with power reverse (R. 913).

J. J. FITZGERALD, age 45, years of service 29, N. Y.

N. H. & H. Never experienced any physical effects (R. 917).

James F. Jones, age 55, years of service 31, N. Y. N. H. & H. Manual reverse has had no physical effect upon witness (R. 921).

Edward Landers, age 54, years of service 33, N. Y. N. H. & H. Never at any time noticed any physical effect as result of manual gear (R. 927).

Wm. E. Pectal, age 55, years of service 29, N. Y. N. H. & H. Never noticed any difference between either gear (R. 929).

A. C. Adams, Supt. M. P., age 65, years of service 47, Nor. Southern. Witness states his company has had no complaints from enginemen about being fatigued or overexerted (R. 934).

J. H. Barker, age 42, years of service 24, Western Maryland. Physical condition at end of day's work very good (R. 947).

Walter E. Butler, age 47, years of service 31, Western Maryland. Condition at end of day's work, witness states, is 100 per cent (R. 950).

J. H. Dalzell, age 45, years of service 26, Union Pacific. Witness stated he never experienced any undue fatigue as result of operating hand reverse gears (R. 1088 and R. 1095).

George E. Stearns, age 54, years of service 28, Union Pacific. Never experienced excessive fatigue from operation of engines equipped with hand reverse gears, and by that witness said he never got so tired that he could not work every day, no extra strains or anything like that. Would not be any more tired after 12 or 14 hours' work on a hand reversed engine than for the same length of time with a power reverse (R. 1096).

J. W. BURNETT, Asst. Gen. Supt. M. P. & M., age 41, years of service 25, Union Pacific. Witness stated he has never received a complaint from an engineman that the hand reverse gear tired him during his day's work, or interfered with the safe operation of the locomotive (R. 1110). Has never observed any engineman suffering from physical overexertion as result of hand reverse gear (R. 1110).

E. B. HALL, Gen. Supt. M. P. & M., years of service 42, C. & N. W. Witness explained that as a result of the use of the manual reverse gear, he never experienced any undue physical exertion (R. 1211).

JOHN MALONEY, age 61, years of service 30, C. & N. W. Witness stated the levers of hand reversed engines never at any time caused him to overexert himself in any way, nor did they ever have a bad effect upon him in any way. And in the early days witness testified he worked from 14 to 16 hours a day with them (R. 1246).

III. ABILITY TO MAINTAIN LOOKOUT.

COMPLAINANTS' WITNESSES.

(a) With Hand Reverse.

(b) With Power Reverse.

LOOKOUT.

FRANK STONE, age 56, years of service 30, C. & A. (a) Cannot keep a lookout but only a short distance ahead while hooking up or dropping down reverse lever, but can look ahead through front window (R. 242). Never had an accident due to failure to see signal or highway crossing (R. 249).

(b) Speaking of the Ragonett type, if properly in-

stalled unnecessary to change your position while looking out (R. 244).

M. J. HUNT, age 55, years of service 19, D. & H. (a) Unable to keep attention on switchman or persons along the track while reversing on double cab engines (R. 253). In regulating cut-off unable to keep attention on lookout (R. 254).

(b) In switching and road service you are constantly looking ahead, and can sit in any position and make movement with the reverse lever (R. 255-6).

W. A. GREENWOOD, age 60, years of service 45, D. & H. (a) At times you have to take your eyes away from front window to brace yourself and reach for reverse lever (R. 259).

LE ROY STUCKEY, age 51, years of service 30, Penna. (a) Witness explained he was unable to see men on the ground and other objects in switching service (R. 264).

C. B. IRWIN, age 58, years of service 32, Penna. (a) In switching service unable to keep attention on men on the ground while reversing screw reverse (R. 267). On cross-examination witness stated he gets signals by putting head out of window and then operates manual lever, looking out again at once to observe signals (R. 268). The reversing is done after the engine stops (R. 268).

(b) Can operate power reverse and at same time keep a lookout on track and over train (R. 269).

FRANK HURD, years of service 30, Erie. (a) On the hand operated screw reverse gear witness stated it took 21 turns to get into the forward motion, and this interfered with your lookout duties (R. 274-5).

B. A. SNODDY, age 53, years of service 24, C. C. C. & St. L. (a) In switching service, having a drop seat

witness is either standing or sitting in the window and in this way can look out and observe signals from either direction while using lever (R. 297).

(b) Part of the time can sit on seat box and take signals (R. 297).

J. L. STAKEMAN, age 73, years of service 50, C. & E. I. (a) Required to make movement with reverse lever before you can look out (R. 314).

(b) Can handle power reverse and see what signals are given (R. 313-4).

J. H. AUSTIN, age 52, years of service 29, S. & A. (a) Witness demonstrated position sitting on the seat box from which he can look backwards or forwards out of the window (R. 326), and in that position can look either backwards or forwards out of window to see signals (R. 326).

H. G. WILLIAMS, age 55, years of service 28, C. & N. W. (a) Unable to keep a lookout inasmuch as your head is inside the cab when reversing (R. 330).

ARTHUR R. RUDOLPH, years of service 28, C. & N. W. (a) Almost impossible to keep looking out when hooking up a hard working lever (R. 337). While reversing if you are working ahead you can keep a lookout, but if you are working backwards you cannot always do it (R. 338). On cross-examination, witness explained how he sits in the cab looking out and observing signals from either direction while operating hand lever (R. 340).

WM. H. STRINGER, years of service 21, C. & N. W. (b) Can keep a lookout and reverse power reverse at the same time (R. 348).

J. R. ADAMS, years of service 24, Wabash. (a) In

passenger service while hooking up or dropping down engine unable to keep a lookout on track ahead (R. 353).

J. M. CRUM, age 62, years of service 34, C. B. & Q. (a) Generally gives all of his attention to hand reverse (R. 367).

(b) Can grasp power reverse and give attention to anything else while adjusting it (R. 367).

E. L. BARTON, age 47, years of service 30, Nor. Pacific. (a) Necessary to take mind off of signals to make reverse movement. On cross-examination, witness stated in switching service he could see part of the signals through the front cab window (R. 378).

(b) Could still look out without turning in cab and make reverse movement (R. 378).

C. B. KINNAIRD, age 64, years of service 41, L. & N. (a) Cutting engine back takes your attention away from the way you are running (R. 386).

EARL WALKER, age 39, years of service 18, C. R. I. & P. (a) Have to put all of your attention on reversing the engine (R. 411).

(b) Requires no attention; do not have to look at the reverse gear (R. 411).

NICK W. BRANDT, years of service 16, C. & W. I. (a) Witness demonstrated how he sits in the cab and observes signals from front and rear while using hand lever (R. 418-9).

III. Ability to Maintain Lookout.

Respondents' witnesses.

(a) With hand reverse.

(b) With power reverse.

Lookout.

J. E. Geldbaugh, age 55, years of service 36, B. & O. (a) Would take vision away from the road less than 10 seconds (R. 426) Witness does not recall experiencing any trouble getting signals (R. 427).

(b) Time required about the same as with manual gear (R. 426).

T. W. Pugh, age 60, years of service 44, B. & O. (a) Does not feel that the two operations conflict very much. Neither gear interferes with lookout (R. 447).

Roy Fraley, age 52 years of service 35, B. & O. (a) Never had any difficulty (R. 472).

R. Brotherton, age 49, years of service 32, B. & O. (a) Operation of hand reverse gear at no time interferes with his ability to keep a lookout for signals or highway crossings (R. 483).

R. C. Schraffenger, age 32, years of service 8, B. & O. (a) Hand lever has never interfered with witness' ability to keep a lookout (R. 498).

L. G. Route, age 53, years of service 29, B. & O. (a and b) Experiences no difference between the two gears (R. 516).

B. F. Freeland, age 59, years of service 33, B. & O. (a and b) Never had any difficulty with either hand or power reverse gear getting signals (R. 521).

JAMES A. WARD, age 54, years of service 34, B. & O. (a) Never had any difficulty getting signals (R. 542).

DANIEL F. CROWLEY, age 68, years of service 41, Ill. Cent. (a) Has always been able to keep lookout while operating hand reversed engine (R. 548).

C. P. MCCASKILL, age 56, years of service 32, Ill. Cent. (a) Never has any difficulty receiving signals (R. 553).

G. C. BUELL, age 67, years of service 44, Ill. Cent. (a) No trouble, either forward or backward, getting signals (R. 555).

W. K. RUST, age 64, years of service 46, Ill. Cent. (a) Never had any difficulty (R. 557).

ERNEST C. RICHTER, age 42, years of service 22, C. & N. W. (a and b) Always able to keep lookout with hand gear, and saw no difference in the two (R. 564).

CHARLES S. THORP, age 69, years of service 51, C. & N. W. (a) Could always get himself in good position without any exertion and get signals (R. 575).

FRANK ELLIS, years of service 35, St. L. S. F. (a) Never ran by a signal during 17 years as an engineman (R. 605).

HENRY E. BLOWERS, age 63, years of service 49, C. & N. W. (a) Never had any difficulty (R. 635).

F. C. MEYER, age 56, years of service 39, C. & N. W. (a) Never had any difficulty (R. 638).

C. A. JEFFERS, age 53, years of service 35½, C. & N. W. (a) Use of hand lever does not interfere (R. 659).

J. R. FIELDS, age 56, years of service 40, Ill. Central. (a) Has had no difficulty whatever (R. 666).

W. J. DOOLITTLE, age 53, years of service 32, Ill. Central. (a) Never experienced any difficulty getting signals (R. 668-9).

S. J. BUCKNER, age 54, years of service 27, Ill. Central. (a) Has received signals from all directions, and has experienced no difficulty (R. 669).

H. R. SPIKES, age 56, years of service 33, Ill. Central. (a) Always able to keep proper lookout for signals (R. 671).

H. L. WILLIAMS, age 48, years of service 24, C. & N. W. (a) Never had any trouble (R. 675).

GEO. L. LOSHBAUGH, age 55, years of service 34, Un. Pacific. (a) Never had any difficulty getting and observing signals (R. 697).

W. S. BEACH, age 54, years of service 40, Un. Pacific. (a) Always able to get and observe signals (R. 700).

W. G. KNIGHT, Mech. Supt., years of service 30, B. & Ar. (a and b) Engineer does not have to leave his seat at any time, and can observe signals constantly with same effectiveness as with power reverse gears (R. 722).

J. H. CURTIS, Div. Supt., years of service 30, B. & Ar. (a) No reason why engineers cannot get signals; they always do (R. 725).

W. J. TESCH, age 46, years of service 27, C. & E. I. (a) Never had any difficulty in getting signals (R. 743).

(b) When power reverse is creeping, your attention, naturally, will be detracted from looking head (R. 743).

H. HOEFT, age 45, years of service 27, Grt. Northern. (a) Never experienced any interference getting or observing signals (R. 776).

FRANK O'NEILL, age 49, years of service 31, Grt. Northern. (a) No difficulty whatever (R. 789).

F. SCHALLER, age 49, years of service 31, Pennsylvania. (a) No difficulty in seeing signals (R. 795).

C. E. VERMUEL, age 43, years of service 21, Pennsylvania. (a) Has had no trouble getting signals (R. 800-1).

J. H. HAINE, age 58, years of service 33, Pennsylvania. (a) Cannot recall ever having trouble getting signals (R. 802).

J. F. FLYNN, years of service 29, C. St. P. M. & O. (a and b) Can observe and get signals as good with one as with the other (R. 841).

HARRY J. DAMPMAN, age 55, years of service 42, Reading. (b) Has trouble getting signals due to attention to power reverse when creeping (R. 853).

JESSE TRAYLOR, age 53, years of service 32, L. & N. (a) Has never interfered with performing proper lookout (R. 888).

O. G. MCPHAIL, Fuel Supvr., age 57, L. & N. (a) Has always had ample time and opportunity (R. 898).

L. W. PULLIAM, Travel. Engr., age 58, years of service 33, L. & N. (a) Manual reverse does not interfere with proper lookout (R. 902).

A. E. WOOD, Travel. Engr., age 51, years of service 30, L. & N. (a and b) Ability to perform all lookout duties the same with either gear (R. 906).

W. N. SPAULDING, age 57, years of service 29, N. Y. N. H. & H. (a) Has never experienced any difficulty getting signals (R. 913).

(b) No difference between either gear (R. 914).

J. J. FITZGERALD, age 45, years of service 29, N. Y.

N. H. & H. (a) Never interfered with getting signals (R. 917).

JAMES F. JONES, age 55, years of service 31, N. Y. N. H. & H. (a) Never has bothered him in any way (R. 921).

EDWARD LANDERS, age 54, years of service 33, N. Y. N. H. & H. (a) Hand gear does not and never has interfered with getting signals (R. 927)

WM. E. PECTAL, age 55, years of service 29, N. Y. N. H. & H. (a) Never had any trouble (R. 929).

A. C. ADAMS, Supt. M. P., age 65, years of service 47, Nor. Southern. (a) States his Company has had no trouble respecting enginemen taking or observing signals (R. 934).

HOWARD BOBBITT, age 55, years of service 39, Nor. Southern. (a) There isn't anything about manual gear which interferes with ability to look out for signals (R. 939).

J. W. BURNETT, Asst. Gen. Supt. M. P. & M., age 41, years of service 25, Union Pacific. (a) Witness stated he "has never heard of nor had a complaint from an engineman in respect to his having any difficulty in receiving signals when operating a locomotive equipped with hand operated reverse gear" (R. 1110).

E. VON BERGEN, Gen. Air Brake Engr., years of service 30, Illinois Central. (a) During his 21 years' experience witness stated he never saw any reason why operating such levers should prevent an engineer from seeing everything he should see for entirely safe operation (R. 1181).

E. B. HALL, Gen. Supt. M. P. & M., years of service 42, C. & N. W. (a) Witness stated "as far as keeping a

lookout for signals, highway crossings, or obstructions is concerned, the handling of the hand operated reverse lever in no way has ever interfered with my duties of keeping a lookout, nor have I ever observed it doing so with any other engineman" (R. 1213).

(b) Amount of attention necessary to give to hand lever as compared with power reverse gear is practically the same. Neither one of them requires enough time or attention to interfere with duties of keeping a lookout (R. 1213).

G. A. MORIARTY, Gen. Mech. Supt., years of service 24, N. Y. N. H. & H. (a and b) With respect to impossibility of maintaining a proper lookout, from his observation and experience there is not much difference in this respect in hooking up an engine equipped with a hand reverse lever or a power reverse gear (R. 1255).

E. R. GORMAN, Supt. M. P. & M., years of service 30, C. St. P. M. & O. (a) While operating the manual reverse gear witness stated his position in the cab was such that he always had an unobstructed view to observe signals of all kinds, as well as pedestrians, track men and vehicles approaching on streets or highway crossings (R. 1275).

(b) While handling a locomotive equipped with power reverse gear witness found it necessary to either look at the quadrant while changing position of lever, or use on hand on lever and the other on the quadrant to place reverse lever in desired position. Experience and observation teaches me, said witness, "that the engineer places the manual operating reverse lever in the desired position with less interference to observation than is possible with the power operated reverse gear" (R. 1275).

A. B. FORD, Master Mechanic, years of service 36, Great Northern. (a) As to hand lever interfering with the duties of the engineman, witness stated in his experience he has not observed it doing so with other enginemen, nor interfering with their view of crossing, nor obstruction; nor has he experienced any difficulty himself (R. 1302).

FREDERICK KERBY, Asst. to Chf. of M. P., years of service 51, Baltimore & Ohio. (a) In his entire experience, witness stated he was always able to keep the proper lookout for signals and highway crossings. He was never reprimanded nor criticized for not observing signals and never had an accident at a highway crossing (R. 1308).

S. M. MOLTE, years of service 34, Southern Pacific. (a and b) Has never experienced any difficulty in his ability to keep a lookout in operating engines equipped with two types of reverse gear,—hand and power (R. 1320). States that while sometimes he may pull his head inside of the window or look inside the cab in switching movements with the hand reverse and then look out again to get the signals from the man on the ground, his practice in regard to operating hand reverse gears is no different than his practice in handling power reverse gears (R. 1323).

IV. Accidents with Manually Operated Reverse Gears.

COMPLAINANTS' WITNESSES.

(a) Cases of strain and rupture.

(b) Cases of placing arms, legs, hands or feet in position to be injured by manually operated reverse gear or wheel.

(c) Cases caused by broken or defective parts of locomotive other than manually operated reverse gear.

(d) Other cases.

Accident.

Frank Stone, age 56, years of service 39, C. & A. (b) Dec. 8, 1930, Fulton, Mo., Engine 347 (Mogul) witness threw his foot up on the lower end of the quadrant when he turned around to hear what brakeman was saying to him, letting go of lever latch at same time and the lever went forward catching his heel. Off duty about 10 weeks (R. 243 and 247). He inadvertently threw his foot over the quadrant and out of the space where he ordinarily kept it (R. 247). W. N. Jones, Claim Agent, C. & A. R. R., introduced signed statement by witness Stone (Exhibit 38) dated January 19, 1931, at Mexico, which, after explaining accident, stated "There was nobody to blame for this accident, which would have been avoided if I had properly inserted reverse lever latch in quadrant. No defects in engine. I have read above statement and it is true. Signed, F. Stone" (R. 811-2; Ex. 11, R. 1394-1400; Ex. 38, R. 1496).

M. J. Hunt, age 55, years of service 19, H. & H. (a) On April 26, (?) witness strained himself; engine just out of shop; she would bind on a curve and it took four men to throw her over. Link motion and all connections tight; engine was just out of shop (R. 255).

(b) In reversing Engine 1029 on October 4, 1927, at Oleonta Yd., which had been defective for some time, hand lever pulled witness in opposite direction, tearing ligaments in his back. Off duty 133 days (R. 254). Right link binding; latch spring too stiff; throttle leaking making reverse lever throw over hard (R. 255). (Bur. Loco. Insp. File 16307) (R. 1400).

W. A. GREENWOOD, age 60, years of service 45, D. & H. (a) April 18, 1925 (or 1926) at Mechanicville Yard witness received a rupture in trying to push hand lever on Eng. 807 in freight service which he stated would bind on curve. Operated on for rupture, and off duty about 5 months, receiving $1100 (R. 260 and 261). Injury due to overstrain on his part (R. 262). Cause of gear working hard due to Southern valve motion (R. 262). Do not have any more (R. 262). Engine standing still when injury occurred (R. 262).

LEROY STUCKEY, age 51, years of service 30, Penna. (a) August 3, 1926, witness received rupture when his foot slipped from foot brace while pulling on reverse lever. Off duty 3 or 4 months, receiving between $800 and $900 (R. 264), caused by his failure to open cylinder cocks (R. 1400-1).

C. B. IRWIN, age 58, years of service 32, Penna. (a) August 6, 1928, Butler, Pa., Engine 259, witness received hernia with screw reverse gear, the pulling of the wheel, which worked hard all night, causing the strain (R. 267). Witness stated he did not know why the gear on that particular engine worked so hard, it being the hardest working gear he ever had (R. 268). Witness testified the hernia was caused by an overexertion, the same as would follow any heavy and continuous strain (R. 269). Off duty 3 months (R. 267).

MATTHAIS GINDER, age 53, years of service 34, Erie. (a) May 6, 1928, between Canton and Barberton, Ohio, Engine 3064 had just come from shop and everything on her was new and you could hardly reverse her. After

attempting to reverse her witness strained his hip, the fireman then handling her (R. 277). When lever was beginning to work hard engineer would use the lubricator and adjust it (R. 279). Off duty about 3 months (R. 277).

PATRICK FLOOD, age 51, years of service 29, N. Y. C. (a) August 29, 1930, witness attempting to get lever up one more notch put his foot on boiler butt and gave it a good pull. Doesn't remember whether foot slipped or not, but felt a sting in his groin, a lump developing, and operated on for double hernia . Off duty about 100 days. Company paid hospital expense and half time, which amounted to $350. (R. 294).

(b) July, 1929, at Millerton, witness had engine in front motion and decided to pick her back a little. In doing so he put his foot up close in back some place and engine went spinning. Witness hung on to lever and it went down on his leg. Witness did not report this accident (R. 293). Off duty 4 days (R. 293).

J. R. PRICE, age 55, years of service 28, C. & O. (a) Dec. 27, 1928, St. Albans, W. Va., in pulling Engine 390 over foot slipped off little step on false running board and witness fell backwards, rupturing himself (R. 309). Witness was throwing lever before he got into his regular position in the cab (R. 310). Off duty two months, receiving $210 (R. 309).

H. G. WILLIAMS, age 55, years of service 28, C. & N. W. (a) In throwing Engine 1880 back at Deering Yard, in 1925, lever flew back. Attempting to shove it down it wrenched the witness, causing a rupture (R. 329). Injury may have been due to a bad counterbalance spring, witness stated. Engine standing still at the time (R. 332). Lost no time off: (R. 330).

(b) Back in 1927, at 40th St. Yds., witness in applying the brake and catching hold of the lever on Engine 1893,

gave the lever a pull (R. 331) and it flew back catching his arm and spraining his wrist, pulling him across quadrant. Witness could not say what caused lever to jerk back. Off duty 12 days (R. 329). The lever came over very easy (R. 331). Witness stated that is only time this engine ever jerked down so hard with the manual reverse. Since witness had not been running that engine for about a year with the manual reverse he stated that he may have been somewhat out of practice (R. 332).

ARTHUR R. DOMINI, age 45, years of service 19, C. & N. W. (a) In March, 1916, at Madison, Wis., witness when working as a hostler attempted to reverse Engine 2218. After getting lever half way over it stuck, and in pulling on it a sharp grip pierced his side, resulting in rupture. Off duty 100 days, receiving $320 and hospital expense (R. 334). There wasn't any jerk or sudden pull of the lever as there was nothing to jerk, the parts all standing still (R. 335). On another occasion in 1919, at Madison, Wis., Engine 818 had been standing for 10 hours in the cold, everything being frozen, and pulling her off center witness sprained his back. Off duty about a week (R. 334). Cold weather was cause of engine working hard (R. 334). Witness did not thaw the ice off valve motion before starting engine (R. 335).

L. J. LARSEN, age 48, years of service 27, C. & N. W. (a) January 23, 1929, at Long Pine, Nebraska, Engine standing, placed foot on foot pedal placed on front end of quadrant and applying all his strength foot slipped off pitching witness forward to front of cab, causing a rupture. He stumbled, fell and had a fit of coughing on leaving boarding house 1 year later causing strangulation of rupture. Off duty 30 days; hospital bill paid (R. 345-6).

ARTHUR R. RUDOLPH, years of service 28, C. & N. W. (a) July 17, 1925, throwing lever back to start Engine 2016 it did not come back, and pulling hard as was pos-

sible witness wrenched his back. Does not know what caused engine to work hard. Off duty 3 days (R. 338). Witness stated combined strain of previous day, together with strain on this engine, had tendency to produce strain. There was no jerking of lever as engine was standing still. He failed to open cylinder cocks. After injury witness had same engine 3 or 4 days and had no trouble with it, nor ever had any other injury before or after that (R. 342).

(b) July 20, 1929, at Salem Gravel Pit, after tugging on lever to pull Engine 1363 back (just out of shop) witness didn't stop quickly enough and lever caught his foot between back of cab and reverse lever, bruising it. Lost no time off (R. 338). Has had no trouble with this engine since, as he put in a stop-pin and fixed it so there was room for his foot (R. 340).

A. C. Rasmussen, years of service 21, C. & N. W. (a) On November 19, 1925, Dodge Center, Minn., witness assisting engineer to pull lever back on Engine 1605, standing on running board, strained his back. Off duty 58 days, receiving $200 (R. 349-350). The valves were dry and apparently no steps were taken by the witness to relieve this before trying to force lever. Because of position witness was placed in, throwing all of his weight on one foot, and leaning around the corner, he thus caused the strain (R. 350).

Otto Inglett, age 57, years of service 28, A. T. & S. F. (a) May 25, 1929, at Corcoran, Calif., witness in attempting to reverse engine 441 strained muscles in his arm and shoulder. Off duty 5 days (R. 373). On another occasion throwing the engine in back motion it strained him and laid off for 3 days. No damage. Cause of this accident witness stated was due to the engine working water and having a dirty boiler (R. 373-4).

E. L. BARTON, age 47, years of service 30, Nor. Pac. (a) May 15, 1929, Darling, in pulling reverse lever on Engine 1578 to further end of quadrant witness strained muscles in his back. Off duty 15 days, receiving $85 (R. 376). Witness stated strain was due to his own exertion and not from movement of the bar (R. 377). The only injury witness ever received with hand lever during 23 years' handling of them (R. 378).

C. B. KINNAIRD, age 64, years of service 41, L. & N. (a) January 4, 1930, witness in shoving lever into forward motion felt pain on left side below the abdomen. Examination disclosed muscles and ligaments pulled loose from his pelvic bone. Off duty about 5 weeks, receiving between $180 and $190 (R. 386-387). Witness discovered after accident that the valves in the valve seat were cut. Only time witness strained himself in 35 years' service (R. 388). Inspection showed valve yoke fit too tight (R. 1418).

JAKE PASCHALL, age 33, years of service 13, L. & N. (a) April 10, 1928, Erin, Tennessee, witness was firing Engine 203 and because engineer was not physically able to reverse engine he attempted to reverse it for him, but in doing so he stretched out with foot braced against tank and his foot slipped and he received a rupture. Off duty 14 days (R. 390-391).

J. M. DIXON, years of service 29, L. & N. (a) June 10, 1928, Louisville Coach Yard, after witness had made a coupling, reverse lever of Engine 999 stuck and in attempting to get it over he received a rupture. Off duty 50 days, receiving $180 (R. 397-398). Witness admits that he had trapped steam in cylinders and did not take time to open the cylinder cocks and drain the steam. Witness stated lever did not kick or injure him but it was his strain trying to throw it over (R. 398).

H. C. GANS, age 52, years of service 28, L. & N. (a) In pushing lever forward on November 26, 1926, witness stated he braced himself securely on floor of cab and tore the ligaments and cartilage along his right knee, caused by cylinders full of steam. Witness didn't open cylinder cocks. He admitted he could have released the pressure by so doing. In June prior to this accident witness bumped the same knee (right) climbing on engine and a knot formed under it which had to be lanced. Off duty 4 months, receiving approximately $500 and doctor's bill. This first accident had nothing to do with the lever (R. 394-5).

J. B. POOL, age 58, years of service 25, C. R. I. & P. (a) In 1925 or 1926, witness gave reverse lever hard push on Engine 109 and ruptured himself (R. 403). Stated that steam chest may have been full of steam and he might have opened the cylinder cocks and reduced force required, but he did not (R. 407).

(b) On June 29, 1928, Komalty, Oklahoma, Engine 1402 reversed itself, and lever flew back while witness was sitting on seat box, grazing his head, knocking his glasses off, skinning his face and ear, and cutting his knee cap. Off duty 3 months, receiving $2000 and hospital expenses (R. 402-403). Inspector's report shows accident was caused by the breaking of the front hanger of the right front driving spring which must then have caught under the eccentric blade (R. 1418). Witness stated if he had been sitting on seat next to the cab window he might have been out of way of lever (R. 407-408).

EARL WALKER, age 39, years of service 18, C. R. I. & P. (a) On February 2, 1929, bringing Engine 1873 down to 3 or 4 miles an hour lever moved back 7 notches, striking witness in left side, causing a rupture. Wit-

ness stated cause of lever flying back was due to breaking of spring steam equalizer permitting driving spring to fall behind the eccentrics. Off duty 91 days, receiving $663 and hospital expenses (R. 410). Witness stated accident due to spring steam equalizer breaking, and not caused by any inherent defect in the reverse lever. The only injury witness has sustained with manual reverse lever (R. 412). Flaw caused breakage (R. 1419).

F. E. Speas, age 52, Penna. (b) In attempting to hook up reverse lever on Engine 2285, (Stephenson valve motion) on February 7, 1929, lever kicked, and in making a grab for it it kicked back and knocked witness' elbow against the cab, an X-ray showing a bone was cracked in his hand. Witness stated he could not say whether he got the lever latched up properly or not. Off duty about 2 months (R. 270). (Bur. Loco. Insp. File 17295, Feb. 18, 1929). Latch worn; grease between quadrant teeth (R. 1401).

Ray D. Diller, age 51, years of service 30, Penna. (b) Witness stated while engine was drifting down hill the bar caught him on side of hip, leaving black and blue mark. No time lost. The cause of lever going forward was due to drifting, witness stated (R. 272).

(c) While switching December 20, 1927, the throttle came open leaving steam in cylinder without knowledge of witness. The latch failed to catch the first time and tore a rib loose and also the ligaments on his left side (R. 271-272). Witness stated he pushed the throttle back in a hurry and it didn't close completely. Contradicted himself, saying lever did not jump ahead but simply moved by his effort. Injury caused by engineer's hurry; steam trapped; throttle defective (R. 1403-5). Off duty about 5 weeks (R. 272).

W. T. Lawrence, age 71, years of service 40, Erie.

(b) On May 5, 1927, between Burns & Arkport on Buffalo Division the lever on Engine 2029 worked hard, and as witness and fireman were jiggling it down it pushed witness back, catching his elbow between reverse lever and injector pipe, thinking he was clear of it, but just enough to catch him, breaking one bone in his wrist and slivered and bent another bone. Witness stated the small teeth and particular arrangement did not hold the lever as ordinary type of quadrants with larger teeth and deeper notches (R. 282). Witness has used hand lever only three times since 1925. Injury was caused by the valve parts and valve motion being too tight and counterbalance spring had not been adjusted to sufficient tension, the engine just coming out of shop (R. 284). Off duty about 3½ months. Received between four and five hundred dollars, together with doctor and hospital bills (R. 282). (Bur. Loco. Insp. report, file 15949, May 25, 1927) (R. 1406).

Lincoln G. Tanner, age 49, years of service 27, Boston & Me. (b) On Dec. 4, 1928, Engine 3611 (Pacific type) at Rockport, Mass., began to kick on the lever as though not getting proper lubrication. Reaching to increase flow of oil lever jumped two or three inches. In jumping witness' heels struck against seat box, throwing his left leg up a little, the lever breaking a small and large bone (R. 286). Witness stated no danger of lever flying while engine was standing still (R. 287). If this engine had had a lubricator which could be reached by standing on running board or from witness' position in seat box, witness stated he would not have been hurt (R. 288). Off duty six months (R. 287). Cause: insufficient clearance between lever and brake valve (R. 1407).

James Brown, years of service 38, N. Y. C. (b) On Sept. 24, 1929, between Lacona and Richland, engineer

in adjusting lever pulled it a little by center and she went to corner, taking witness with her, breaking his forearm (R. 290). Witness got this engine from another crew and did not bother to examine lubricator, taking it for granted it was all right. Plenty of oil, but wasn't feeding enough (R. 291-292). His pulling the lever in back motion as engine was going ahead and the lever then going forward when latch was released, had a lot to do with cause of accident (R. 292). Only accident to witness during 38 years' service ever reported to I. C. C. (R. 293). Off duty about 5 months (R. 291). Nothing wrong with reversing gear. Accident caused by improper method of handling lever (R. 1407-8).

B. A. SNODDY, age 53, years of service 24, C. C. C. & S. L. (b) April 16, 1929, reverse lever went into corner, striking his leg 3½ to 4 inches above ankle bone and breaking it (R. 298). If witness had kept his foot on floor in front of him or any other place to brace himself he would not have been injured. He stated he was not conscious of having put foot in way of lever (R. 299-300). Off duty 86 days, receiving $500 and doctor's bill (R. 298). Contributory defects: teeth badly worn in reverse lever latch and partly filled with grease and dirt (R. 1410).

W. B. SOUTHARD, age 52, years of service 25, Mich. Cent. (b) November 20, 1927, mile west of Lawton, lever jerked and went into corner. Getting it back half way witness became overbalanced and lever took him down with it, fracturing two ribs. Off duty about 5 weeks (R. 306).

OWEN HOWARD, age 53, years of service 32, B. & O.

(b) December 3, 1927, at New Concord, Ohio, witness reached over to shove independent brake valve on Engine 4306, and the reverse bar came down on his hand, bruising it (R. 318). Off duty 10 days. Causes: Loose quadrant and insufficient clearance ($\frac{3}{8}$ in.) between lever and brake valve (R. 1412).

J. H. AUSTIN, age 52, years of service 29, S. & A. (b) December 18, 1929, at Sand Pit, as Engine 114 was picking up speed witness unlatched the lever with right hand and caught hold of lever with left hand to push up towards center to get short cut-off and reverse lever jumped back and caught his hand and sprained his wrist. Off duty 20 days; receiving about $140 (R. 322). Witness placed himself in awkward position (R. 325).

WM. H. STRINGER, years of service 21, C. & N. W. (b) On January 25, 1929, Wiscona, Wis., witness noticed Engine 29 was dry, valves were dry, and lever began to pound and rattle. Placed foot on boiler head and pulled to get out of corner. When half way up foot slipped and pinched between lever latch and air pipe, injuring two toes. Off duty about six days. Engine 29 had been on storage track at shop for at least a month before this trip. If witness had kept his foot where he had it at first he never would have slipped. Prior to trip witness failed to oil the links and driving boxes (R. 348).

J. R. ADAMS, years of service 24, Wabash. (b) In hooking up lever May 4, 1929, engineer placed foot on boiler head in front of lever whereupon lever went forward against his foot breaking it. Off duty 7 months, receiving $2000 (R. 354). Did not know why lever went forward. Witness reversed the hand lever on this engine at roundhouse prior to taking her out and she

worked very nicely (R. 357). The jumping of the lever to forward motion was due to either worn quadrant or quadrant had dropped a little (R. 357). Contributory cause: No clearance between boiler-head and lever (R. 1413).

WM. A. GARMAN, age 54, years of service 29, St. L. S. F. (b) On June 1, 1930, lever went into corner and pinned witness' finger between boiler head and reverse lever, breaking and mashing it. Off duty six weeks; received $300 (R. 363). Cause of lever going to corner due to some one putting excessive amount of oil on reserve lever latch and same getting on quadrant; also stop pin in forward end of quadrant was missing and witness had not observed this (R. 363). After accident quadrant was washed and there was no more trouble (R. 364, 1413-4).

J. J. ROGERS, years of service 26, C. B. & O. (b) March 3, 1930, unable to reverse lever on Engine 1750 and received a slipped vertebrae and displacement of the sacroiliac articulation, which was the wedged shaped bone in his hip. Off duty nine days (R. 370). The resistance to this lever was due to steam cylinders and witness did not open cylinder cocks (R. 371) although admitting this would have released pressure (R. 371-2).

C. P. YOUNG, age 62, Grt. Northern. (b) January 26, 1929, Stone Hill, Montana, reverse lever on Engine 905 went into back corner striking witness' knee a glancing blow, causing blood clot on knee cap. Off duty 25 days, receiving $150 (R. 413). Witness stated engine had broken a rocker box. This is the oldest engine they have in service in witness' territory. Witness said he had his legs sticking outside of the box and there was plenty of room for him to get his legs out of the way; lots of room between the quadrant and the cab (R. 414). Accident was caused by negligent installation of plugs in valve pressure plate (R. 1420).

NICK W. BRANDT, years of service 16, C. & W. I. (b) January 7, 1929, in throwing lever on Engine 215 in forward motion it sprang away from witness, striking his hand against drain pipe, cutting knuckles open and causing lacerations and contusion of back of the hand. Stop block was missing from front of quadrant. Off duty 32 days, receiving $232 (R. 416-417). Counterbalance spring had been out of balance all that day, and witness made no attempt to adjust it, although he admits it would have taken about 10 minutes (R. 421). Another accident about July or August, 1927, witness' foot slipped from boiler and wedged against side of boiler, injuring the arch in his foot slightly (R. 417).

HARRY LOWE, age 43, years of service 19, (Formerly) N. Y. C. & St. L. (c) April 20, 1928, Dillon, Indiana, Engine 383. Witness unable to remember what had happened, the following is a brief resume of this accident taken from B. of L. In. Report 16708 dated April 22, 23 and 24, 1928 (R. 1414-5):

While backing up at about 20-25 m. p. h. with a locomotive running light, engineer was standing up with his hands on lever as if he were going to hook up nearer the center, according to statement of fireman. Engineer states he was sitting on the seat box with his head out the side window and his right hand on the reverse lever and he had no recollection of what happened after that. The next the fireman saw was the engineer being thrown forward against the boiler back head, then backward against the coal gates where he lay unconscious, the broken reverse lever beside him. The B. of L. I. inspector concluded the cause of the accident was the reverse lever going into full backward position forcibly, allowing the valve to over-travel and catch the broken exhaust ring on the end of the valve chamber bushing

causing the gear to reverse and throw engineer forward and then backward. This however is mere conjecture.

Contributory defects found: 60 per cent defective weld in reverse lever—back exhaust valve ring broken.

Injury: Cut on right side of head, cut on right knee, right arm broken below the elbow, both bones. Left arm broken above elbow. Left leg broken above ankle, both bones. Probable disability—indefinite. Witness received $17,000. Witness now operating an 80-acre farm since 1929, performing all duties himself except threshing (R. 383).

(d) Engine 5501 was ordinarily used in freight service but on one occasion was put into passenger. Something happened to the valve mechanism and reverse lever started to thresh backwards and forwards, and when engine had stopped it developed the eccentric rod had broken (R. 383-384). No one injured.

Frank Small, age 74, years of service 56, Main Central. (a) April 15, 1927, main driving axle broke, striking the reach rod, throwing lever into back gear, breaking witness' leg. Off duty ever since. Received $14,000 and hospital expense. Cause: axle breaking due to old flaw—60% of cross-sectional area (R. 315, 1411).

Bert Underwood, age 44, years of service 21, Wabash. (a) When reversing Engine 497 on September 7, 1927, counterbalance spring broke, causing witness to fall against throttle-lever, striking him in neck, causing temporary paralysis of vocal chords. Off duty 20 days (R. 358-9). Inspector held casual examination of spring would have disclosed old break and prevented accident (R. 1413).

Frank Hurd, years of service 30, Erie. (c) January 17, 1929, at Pieffer (5 miles east of Kenton, Ohio), witness stated he was scalded; screw gear Engine 3033.

The reversing wheel gears went up and we (fireman and brakeman) went out of cab on account of the hot steam pulling out the boiler studs. The bracket studs pulled out of reversing gear (R. 275). Witness slightly scalded about face, and in jumping 12 to 14 feet hurt his back falling on track. If there had been a hand lever working on the quadrant of that particular locomotive witness stated there would not have been that kind of accident (R. 275-276). Cause: Valves stuck because not lubricated (R. 1406). Off duty about 15 days, receiving $180 and hospital expense (R. 275).

A. K. Pearce, age 41, years of service 20, S. A. L. (d) May 18, 1928, Oxford, N. C., no stop pin in the quadrant of Engine 1564 and witness' finger came in contact with the stud that holds the jacket on, mashing the nail to the bone. Witness stated missing stop pin was cause of accident (R. 312). Off duty 14 days (R. 311). Quadrant was set up backwards (R. 312).

J. L. Stakeman, age 73, years of service 50, C. & E. I. (d) January 31, 1930, six miles from Evansville, witness' leg was broken on Engine 210 (Atlantic type) when lever went into corner when spade or dog was raised. Struck leg against air pipes coming down from brake-valve is what caused leg to be injured. Placed foot on boiler head in front of lever (R. 313).

J. M. Crum, age 62, years of service 34, C. B. & Q. (d) November 21, 1928, mile from Union Depot, preparatory to stopping Engine 2830 witness pushed lever forward and it came back and struck his right breast, knocking breath out of witness. Off duty 19 days, receiving $176.86 (R. 366). The only injury witness has ever sustained with hand reverse gear (R. 367). Accident was caused by improper lubrication of valves over a period of 3 weeks, repeatedly reported; caused valve finally to break (R. 1415-6).

COMPLAINANTS' REBUTTAL WITNESSES.

JOHN H. MCHUGH, years of service 39, Great Northern. Stated that he had used hand lever for braking purpose on a number of occasions but had trouble only once. On this occasion the witness was backing up to hook up to some cars. When he was close to the cars he applied the brake but because it was frozen it did not function. He then tried the hand reverse as a brake but crashed into a baggage car as the hand lever flew back (R. 1325). On cross-examination he stated that he did not use hand reverse lever until he was ten feet away and that when he brought it back it did not stay (R. 1329).

J. M. WYATT, years of service 9, Pennsylvania (formerly). Testified to an accident on February 26, 1923. He brought an engine equipped with hand reverse gear out of the roundhouse on the turntable and turned it around. Witness then opened throttle and put reverse gear in forward motion, intending to stop at the water block for water. He could not close throttle because the arm had broken off. He then set brake and attempted to reverse the hand lever but could not get it on center. The brake was not effective because of insufficient air to hold against the open throttle steam pressure and he was unable to stop the engine; he said: "If I was able to reverse it or could have gotten it on center, I could have controlled it." Witness made a second attempt to reverse the engine about the time the brakes gave way, and then he got off and let the engine go (R. 1359). Witness felt the reason he couldn't reverse the gear was because it worked hard and with the broken throttle the high steam pressure made it work harder (R. 1359-1360). The engine was new out of shop, but witness had just reversed it twice in moving it to and from the turntable

(R. 1360). The same result would have occurred in this case if the engine had been equipped with a power reverse gear which stuck or would not operate (R. 1361). Further evidence of excitement of this witness is shown by his getting off the engine entirely and go to the yard office for assistance and then going back and getting on the engine again before making his last effort to reverse it (R. 1359). He was relieved from duty for allowing the engine to get away (R. 1361). According to the report of this accident to the Bureau of Statistics of the Interstate Commerce Commission, Exhibit 105, the witness became very much excited and after several ineffectual attempts to stop the engine he became alarmed and deserted it. The engine finally crashed into another engine, killing the engineer, injuring the fireman painfully, and slightly injuring the conductor. The report states this engine had been turned out of the shop 3 days before the accident but as far as able to determine after the accident there was nothing defective about the brakes, reverse lever or valve gear that would have prevented this hostler from controlling the engine after the throttle lever fulcrum was broken off (Ex. 105, R. 1575-7).

M. M. Moore, years of service 24, L. & N. On October 31, 1919, witness was a hostler and was asked to move an engine undergoing repairs. He started the air pumps and obtained full pressure of air. When he started the engine the manual reverse lever was in forward motion. When he tried to stop the engine, the brakes did not apply as they had been cut out. He then tried to reverse the engine but could not move the reverse lever because "a piece hung in the quadrant". The engine went through the roundhouse wall. No one was injured (R. 1361). Was about eighteen or twenty feet from roundhouse wall and could have stopped the engine before hitting the wall if he had been able to operate the hand lever. Bases this

statement on the fact that he has stopped engines by the use of the hand lever in such short distance in cases of this kind (R. 1363). He stated that if the engine had been equipped with a power reverse gear he could have stopped the engine (R. 1361). He admitted that if the power reverse lever had stuck like the hand reverse lever, the result would have been the same (R. 1363). When repairing engines all these air devices are cut off (R. 1362). With the air reverse the result would have been the same unless witness "cut it in" before starting (R. 1363); and it was his failure to "cut in" the brakes which caused this accident, he having started off with the engine without trying out either brakes or lever (R. 1362-3).

The engine was 18 or 20 feet from the roundhouse wall, and witness stated he could have prevented the accident if he could have operated the hand lever, as he had used hand levers in cases of this kind (as a substitute for a brake) and had been able to stop in that short distance (R. 1363).

Leo F. Cloud, N. Y. C. Engineer asked the witness to get down on the ground and observe the movement of the counterbalance spring and to adjust it. Witness got down and placed hand on the bell crank frame in order to pull his body to a position where he could see the spring. Witness then told the engineer to reverse the engine, not realizing the position of his hand. When the gear mechanism was reversed the little finger was caught between the reversing arm and the back of the gear frame, badly pinching it and breaking a bone, which was discoverable only by using X-ray (R. 1391-2). Lost three weeks and received $85. Doctors and hospital bills were paid. The finger was caught by the reversing yoke at the extreme back end of its swing toward the frame upon which the hand rested (R. 1391).

W. H. CALAME, years of service 19, Union Pacific. On September 20, 1920, witness was operating an engine equipped with hand reverse gear. He was sitting on the seat box with his back to the window kicking cars back. He put the reverse lever in back motion and had hold of the throttle kicking cars back, looking out of the back window. On this class of locomotive he states you could operate the lever also by straddling it, but your left leg when the lever was put in back motion would be up against the lever. On this occasion, while kicking the cars, the crank arm came off on the left side breaking the brass cup that holds the latch down in the corner. The latch went to forward motion and the eccentric arm dropped throwing the reverse lever back, hitting him on the side of the leg, breaking a bone (R. 1393-4). Off almost six months. Received $2,000. Hospital and doctor bills were paid by the Company. The whole sweep of the lever is located in front of the engineers seat box and with the lever in reverse position it clears the cover of the seat box about 3 inches (R. 1394-5). If desired the seat box could be moved back away from the rear of the lever a foot (R. 1395).

IV. Accidents with Manually Operated Reverse Gears.

RESPONDENTS' WITNESSES.

(a) Cases of strain and rupture.

(b) Cases of placing arms, legs, hands or feet in position to be injured by manually operated reverse gear or wheel.

(c) Cases caused by broken or defective parts of locomotive other than manually operated reverse gear.

(d) Other cases.

ACCIDENT.

FRANK ELLIS, years of service 35, St. L. S. F. (b) Admitting his own negligence, witness, in 1903, having his foot on a box placed at the front end of quadrant dropped the hand lever down and the corner of the latch struck his foot. Doesn't recall losing any time on account of it (R. 605, 607).

W. B. SUMMERS, age 50, years of service 24, C. & N. W. (b) About 20 years ago, witness had nail torn from finger hooking up engine with one hand, there being no stop lug on the quadrant and reverse lever striking boiler head, pinching his fingers (R. 625). Only injury ever received by manual reverse gear (R. 626).

A. C. MCGUIRE, years of service 18, C. R. I. & P. (d) Witness observed engineer caught between reverse gear and driving spring on manually operated engine. Engineer placed his head between tumbling shaft upper lift arm and at end of driving spring. Fireman moved reverse lever in forward motion. As he reversed, engineer hollered and simultaneously fireman moved reverse

lever back again. Engineer cut about temple and face, but not seriously injured, and able to go on his trip. Fireman made a remark that he felt the obstruction when engineer's head was caught (R. 713-4).

The fireman in the cab could not see the engineer as he was under the running board (R. 714). This was Engineer Simmons, now living at Stuttgart, Ark. (R. 714). The end of the driving spring cut through the skin on his right temple; we washed off the blood and found him not otherwise injured (R. 714). The lever was in the center of the quadrant and fireman moved it about half way to the front corner; he was pushing on it slightly; you can move them forward easily with one hand (R. 714-5). The lift arm that shoved his head against the spring is smooth; in moving to forward motion you close up the distance between the two (R. 715). The fireman said he felt the obstruction in the machinery. "I do not have any reason to doubt what he said about that" replied the witness when asked by the Examiner if he believed the fireman felt the obstruction (R. 715).

Harry J. Dampman, age 55, years of service 42, Reading. (d) Lever on hand reversed engine broke off two inches about the quadrant due to a flaw in the iron, and finished the trip to turn-around point (17 miles) and back, by use of monkey wrench 12 inches long on top of the lever. No personal injury (R. 851).

B. H. Canady, years of service 21, A. T. & S. F. (b) Witness when an apprentice getting his valve experience on a hand reversed engine was told by the machinist to let the hand lever down into the corner. A tinner, who was putting the jacket on the boiler had his toes under the reach rod and witness had put it down on them. He didn't lose any time, and he went right on

with his work, not crippling him in any way. This tinner was standing on the running board with his toes under the reach rod which on that engine extended forward above the running board and fastened to the tumbling shaft arm which stuck up through the running board. When the reverse lever was on center the reach rod was 4 or 5 inches above the running board, but when in full forward position it was within a fraction of an inch. When the machinist told witness to put the lever into the front corner, upon doing so it caught the tinner's toes between reach rod and running board and he hollered. Witness feeling the obstruction and hearing the yell, thought the machinist was calling upon him to put the lever down, so he got two other apprentices who were in the cab to help him with the lever and with their combined force they got it down a notch or two more, whereupon some one came in the cab and notified them they had caught the tinner and they released him. No personal injury (R. 1149-50).

G. B. Hayes, age 64, A. C. L. (c) Witness related an experience he had with a manual reverse geared engine which ran off the end of the track. The air would not operate due to a little piece of babbitt over the air port preventing the admission of air to the brake valve. Witness thereupon reversed the engine at 15 miles per hour with the hand lever whereupon the wheels locked and due to a steep grade and short distance the engine went off the end of the track. The lever functioned just as intended and had the same effect as though the brakes had worked. No personal injury. (R. 1208).

V. Erratic Performance of Power Reverse Gear Equipment.

COMPLAINANTS' WITNESSES.

(a) Creeping.

(b) Pumping.

(c) Fluttering.

(d) Freezing.

(e) Broken air pipe connections, etc.

(f) Cases where engine was thrown into reverse motion while moving forward.

PERFORMANCE.

Frank Stone, C. & A. (a) Experienced very little trouble with creeping (R. 244). When they did creep, they would cut themselves off entirely and then drop down again (R. 249).

W. A. Greenwood, D. & H. (a) With Franklin Precision gear, witness stated he cannot move at first movement and has to take slack. (R. 261).

James Brown, N. Y. C. (a) Witness had lever creep on one trip due to packing in the cylinder (R. 291).

(d) Has had a little trouble with the exhaust freezing on the Alco gears (R. 292).

W. B. Southard, Mich. Central. (a) At times, there might be a tight bearing and the Precision gear will turn a little hard (R. 306).

A. K. Pearce, S. A. L. (a) The Precision gear is harder to operate than the Alco (R. 312).

J. H. Austin, S. & A. (a) Witness has experienced

creeping on some Alco engines; some times creep so far it would cut your valve out (R. 323-324). On cross-examination, witness stated power reverse has crept so far back it has cut the engine out. Has two engines that creep pretty badly. They have done so every time he ran them over a period of two or three years (R. 326).

(f) Some times it creeps so far back it reverses the engine (R. 326).

H. G. WILLIAMS, C. & N. W. (a) Has has experience with creeping power reverse engines due to the cylinder packing (R. 330). When gears would creep you could not maintain any fixed cut-off on the locomotive (R. 331).

ARTHUR R. RUDOLPH, C. & N. W. (a) Witness' experience has been that the Ragonett creeps frequently. The Alco is fairly good. Has experienced lever creeping back to dead center which would trap steam in the cylinders (R. 342).

(c) Has also experienced fluttering (R. 341).

A. C. RASMUSSEN, C. & N. W. (a) Experienced one occasion when gear crept from two to four notches and then hooked itself back again (R. 350).

J. R. ADAMS, Wabash. (a) Witness testified to one particular power reverse gear which was so unsatisfactory and hard to keep up that it was of "no account", and was taken off (R. 354-5). This gear was called the "Mellin" (R. 354-5).

BERT UNDERWOOD, Wabash. (a) On three or four different occasions while in road service witness experienced creeping with Ragonnet gears (R. 360).

J. M. CRUM, C. B. & Q. (a) Replaced Ragonett with Barco gear because of excessive creeping of former (R.

366-367). Engine worked harder, nearly shutting itself off, and would back up again (R. 367).

J. J. Rogers, C. B. & Q. (e) Had piston rod of power reverse gear break off causing link motion to drop down the full end of the stroke (R. 371).

COMPLAINANT'S REBUTTAL WITNESSES.

John H. McHugh, Great Northern. Witness stated that Engineer Rowe, one of respondents' witnesses, reported creeping on Engine No. 2513 but not on 2514 or 2515 (R. 1325). On cross-examination witness admitted he, too, had trouble with power reverse creeping in cold weather; and that about 10 days previous to his testimony he reported engine 2515: "power reverse creeps. Examine piston packing" (R. 1326-7). Witness had also experienced creeping because of improper lubrication of power valve gear (R. 1328).

Ralph R. Davis, Great Northern. Had a case when he reported creeping (R. 1331) in August, 1931; and two cases in June, 1931, on the type of engines run by Engineer Rowe (R. 1332).

S. M. Wilson, Northern Pacific. Only noticed an engine creeping one time, while he was keeping record between September 7 and September 28, 1931; would not say as to other periods except that he couldn't remember of any other instances of creeping (R. 1337).

John T. Miller, Baltimore & Ohio. Has reported an engine creeping once in the last year that he recalls; that is only case he remembers; didn't check records (R. 1340).

J. P. Meagher, C. & E. I. In the last 14 or 15 months has had four or five runs when power reverse gear crept, as to which he reported in writing (R. 1342). On cross-

examination stated that about half the time the engine went through and on those occasions he made no written reports. Has had power reverse gear creep over center once (R. 1342).

JAMES MCKEANEY, Reading. Has had no delays because of creeping (R. 1343). Stated that when the power reverse gear is in perfect condition he has had occasions when it will creep to some extent until the engine is warmed up (R. 1344).

D. HARTLE, Baltimore & Ohio. Has had power reverse gear creep a lot of times a notch or two. Has had engines which gave no trouble due to power reverse gear creeping and others which gave such trouble (R. 1350).

R. L. ACKER, N. Y., N. H. & H. R. R. Stated his experience with creeping was infrequent (R. 1357).

MURRAY MCCULLOUGH, Illinois Central. Never observed any creeping on Engine No. 5063, concerning which Witness Rust testified (R. 1367). Has fired for Witness Rust 5 or 6 times. Never lost any time from creeping (R. 1367).

L. P. GOLSON, Illinois Central. Has had very little creeping (R. 1368).

EDWARD R. BOA, N. Y. C. Cited a very recent instance of Franklin Precision gear creeping badly to the extent of five miles on the duplex gauge, every time when going about 30 to 50 or 55 miles (R. 1371). Stated that his recent experience has made him conclude that with power reverse gears point of cut-off would not stay where engineer wanted it (R. 1373). Reports one out of 30 engines which he rides as road foreman of engines in a period of two or three weeks for creeping but as to the other occasions he cannot say that the power reverse gears were absolutely accurate in their cut-off. It is his prac-

tice to report only the ones he considers bad—where creeping amounts to more than 5 miles on the gauge; but there are very few that are right on the dot; they all creep some; I don't believe I have even seen one that didn't creep a little sometime when you are batting them good and wicked (R. 1373-4). Referring to a paper read by him in 1929, witness indicated he considered "ease" of handling power reverse gear its principal advantage, and he admitted it will not hold a fixed point of cut-off and that he had a different idea about it than when he wrote the paper (R. 1370, 1373).

E. W. Erisman, Wabash. On one or two occasions in the period of a year, the Alco gear he has operated has crept (R. 1374). Has made some verbal reports to their engineer of power reverse gear creeping when the engine went through. Practically all of his engines got through (R. 1375). On cross-examination he admitted having filed four written reports in four months with reference to creeping (R. 1375). Made about eight round trips a month (R. 1374).

G. H. Zouck, Franklin Supply Co. The witness, Chief Engineer for one of the important manufacturers of power reverse gears explained in technical language how the "fluttering" or shuttling occurs with certain types (R. 1376-8). He detailed numerous mechanical changes in design of these gears which have been made from time to time, although the older types are still being produced (R. 1376-8). Described the Precision or Screw type gear, stating it will permit the reach rod to the tumbling shaft to move 1¼ inches, but he doesn't know how far that movement permits the valve gear parts to move (R. 1377-8). He also explained how variation in the pull and thrust of the valve motion and variation of air pressure in the reverse gear reservoir result in intermittent

changes in position of the valve gear in ordinary conditions running over the road, both due to conditions beyond control of the power reverse gear and otherwise (R. 1378-9). The power reverse gear acts as a governor, constantly adjusting and readjusting the position of the valve gear—sometimes rapidly, sometimes taking 2 minutes (R. 1380). The witness indicated the Precision type of gear was designed to obtain a maximum micrometer adjustment at any point of cut-off "which we felt had not been possible with the earlier types" (R. 1382). Admitted that when there is sufficient variation in the pull on the valve motion to overcome the preliminary friction in the parts on any power reverse gear the piston will be pulled a certain distance until the valve in the reverse gear can discharge enough air to counterbalance the new forces existing (R. 1379). This is without considering defects or leaks.

G. F. Robinson, Sales Manager, American Locomotive Co. Recited changes that were made from time to time in the design and construction of the Alco gear and stated that these and other enumerated changes were necessary to keep the gear from creeping (R. 1383). Claims creeping has been stopped but added that if a company says the gear creeps he repairs the gear to make sure that the packing is tight and there are no leaks. He only rides 4 or 5 engines a year. And the changes made in 1919 when type E gear was brought out are still in use; even the same packing. On cross-examination the witness hedged and said he wouldn't say the creeping had been eliminated, but that they get no complaint of creeping now (R. 1384). He defined severe creeping as when the cross-head of the gear moves 1 inch or 1½ inches, without movement of the lever in the cab, then the valve moves and gear jumps back, repeating the operation four or five times a mile, as "was brought out

clearly in tests made on our own and eighteen other types of gears in 1919 (R. 1384). Recalled but one complaint of creeping in 1931 but upon his memory being refreshed, recalled four or five complaints (R. 1385-7).

C. L. MELLOR, Barco Mfg. Co. Described certain mechanical changes in the valve that were made with a view to eliminating any movement or greatly reducing whatever movement there might be in the event of lost motion from wear of various parts, largely of the control mechanism (R. 1387-8).

M. M. JOHNSON, C. & N. W. Testified that he has had very little creeping; remembered two occasions (R. 1390-1).

W. H. CALAME, Union Pacific. Has had very little creeping and then only the equivalent of a notch or two (R. 1393).

V. ERRATIC PERFORMANCE OF POWER REVERSE GEAR EQUIPMENT.

RESPONDENTS' WITNESSES.

(a) Creeping.

(b) Pumping.

(c) Fluttering.

(d) Freezing.

(e) Broken air pipe connections, etc.

(f) Cases where engine was thrown into reverse motion while moving forward.

PERFORMANCE.

J. E. GELDBAUGH, B. & O. (a) Witness stated power reverse gears creep, and times when in forward motion they would creep back. Had times traveling 30 miles

an hour could not keep them out of corner without cutting themselves out entirely, and this creeping has been during entire period of witness' handling power reverse, viz., 10 years. When pressed for an estimate, on cross-examination, he estimated creeping approximately 75 per cent of the time (R. 426-7). Eight or nine of his engines out of 12 for one month the lever would go to the corner (R. 436). A check of his work reports, at complainants' request, showed the number of engines reported by him to be less than the above, but a very substantial number.

(b) When air was being pumped up and engine ready to go out, air would go off and gear settle to bottom of links, this occurring without any movement or change in position of control lever of power reverse gear (R. 429-30).

(d) Power reverse gear freezes up at times when mercury down to zero or below (R. 429).

T. W. Pugh, B. & O. (a) Power reverse gear not as good as manual inasmuch as it would move and not hold valve where witness wanted it to be (R. 445). Has experienced them creeping back to and past center (R. 445-6). Witness stated he could not remember any power reverse gears that did not creep, and he has operated Ragonett, Barco and Alco (R. 451).

Junior B. Fraley, B. & O. (a) In our territory, witness stated to his knowledge, there wasn't one Mallet power reverse that did not creep, and was certain he had run all of them (R. 458). Has seen and heard the valve going up and down, and the air blowing, when there was no one moving the bar, and this has occurred on different occasions when engine standing still (R. 459). Had an engine which went lame and speed of train cut down, and

when she would slip a little it would cause a jarring of the train (R. 458).

(d) Unable to move engine because air reversing cylinder was frozen. Experienced this freezing on practically every trip, and every time he stopped in zero, or perhaps not quite zero, weather (R. 456).

Roy Fraley, B. & O. (a) Nearly all of the Mellin gears creep (R. 473). With respect to other gears, witness stated they would creep and would not remain where you would want them to. Has had some that crept and others that did not (R. 474). Power reverse gears in 100 per cent have crept, and gears newly installed within 30 days (R. 480-1).

R. Brotherton, B. & O. (a and b) With Engine 641 witness stated he had considerable trouble with gear creeping and pumping. By pumping witness explained there would be a short piston travel, about two inches, one inch variation each way, which meant loss of control of valve motion of engine. As air would pump up the valve would creep, power reverse would move, moving the gear with it, and this situation lasted for more than a year and a half (R. 483-4). Witness also testified as to similar creeping on Engine 1072, power reverse (R. 484). Engine 1072, type E Alco, crept so badly that witness requested he be taken off and given a manual reversed gear engine (R. 492).

(c) Never ran an engine with power reverse gear that would stay where he put it (R. 493).

(d) On several occasions pipe outside of cab would freeze up. Unable to reverse until thawed out (R. 484).

(f) In going up a hill reverse lever on power reverse would start to jerk and gear would pump, causing reverse lever to jump out of notches, and on several occasions it went over in back motion (R. 484-5).

R. C. SCHRAFFENGER, B. & O. (a and b) Witness stated he has seen power reverse gears creeping and pumping quite frequently until the exhaust would get weak if they were coming towards center, and going the other way exhaust would get very loud (R. 498).

WALTER PRICKETT, B. & O. (a) On practically all power reversed engines witness has ever run he has been unable to maintain proper cut-off account of creeping (R. 504).

(d) Has experienced reverse lever freezing while out on the line. Has had lever freeze when train was going and frozen when train was stopped, consuming 15 or 20 minutes to thaw it out (R. 505).

(e) Has also experienced air brakes freezing (R. 508).

L. G. ROUTE, B. & O. (a) Witness had regularly assigned Engine 4598 and experienced considerable trouble with it creeping. When starting to pump and recharge the air system the blocks would lift up and drop (R. 511). Witness has operated the Q-4 or the Q-4-A engine which did a lot of creeping (R. 511).

B. F. FREELAND, B. & O. (a) With type Q-3, 4500 engines, they crept pretty badly most of the time (R. 521). Some power reverse when new do not creep, but they are not run very long before they do (R. 525).

(b and e) While running Engine 5501, January 7, 1929, at 45 miles an hour, witness observed air reverse piston going from one end of cylinder to the other, backwards and forwards, pumping, breaking engine down on left side. Bolts in lifting shaft arm on left side broke (R. 521-2). A week later witness had same engine and experienced same degree of pumping and connection lever to eccentric rod had broken, left side, also air pump and air brake had broken, and had to get another engine

(R. 522-3). Air reverse caused connecting rod to break (R. 523).

(f) Attempting to cut engine back in short cut-off the creeping of the bar put it back in back motion, causing train to run into engine and someone reported him for rough handling (R. 523-4). On another occasion he was delayed 20 minutes because power reverse would not move and fireman had to take the grate shaker and get hold of the links, which is dangerous (R. 524).

F. R. McFarland, B. & O. (a) This witness testified to operation and maintenance of power reverse (as a machinist and testing them), especially the Meline gear, saying it was usually too weak to throw the gear, and if too tight it created a friction on the cylinder, and took all the air pressure to move the power reverse (R. 529). With respect to Ragonett A, witness stated it crept due to lost motion, packing too tight in cylinder, and lost motion on connecting rods and links (R. 529). Also air leaks around piston rods (R. 530). Testified Ragonett Type B had same trouble as Type A. The Barco has not got the power to move the gear on the Mallet engine (R. 530-1). Witness recalled an instance of Ragonett Type B power reverse when cylinder packing was clamped in cylinder and it hesitated and knocked the front head out of the power reverse cylinder (R. 534). It is seldom a classified engine comes to the shop that the power reverse is not reported creeping or to overhaul power reverse (R. 538).

James A. Ward, B. & O. (a) On the Ragonett, Alco and Barco which witness has operated, he testified he has not seen one that did not creep (R. 540).

(a and b) Due to excessive creeping (or pumping) witness testified he broke a reach rod (R. 545). Has also experienced reverse gear pumping so as to endanger the valve gear (R. 540).

C. P. McCaskill, Ill. Central. (a) On one occasion after hooking engine up it would stay for a few minutes and then drop down again and come back, almost cutting off the exhaust (R. 554).

W. K. Rust, Ill. Central. (a) Has had a number of instances of creeping (R. 558).

(b) Pumping happened very, very often (R. 558).

Ernest C. Richter, C. & N. W. (a) Has had various engines where reverse gear would creep two or three notches and back again, and this condition has extended over his 10 years' experience (R. 561).

(d) Had one experience during zero weather when power reverse would not function due to air cylinder freezing (R. 562-3).

(e) Has experienced much difficulty in power reverse failing to respond on air cylinder, and when responding she takes it with such volume she carries it beyond notches set for it. This happens 4 or 5 times a month (R. 561-2).

(f) Had one case when hooking up engine obliged to give her three notches before she responded to the air, and when she did respond she put the lever in backward motion, bunching the train. The train parted, breaking a knuckle. Strain was so great it broke the eye on the rear drawbar on the tender. This happened between St. Francis and Belton, going to Butler (R. 561).

H. Herrick, C. & N. W. (a) Has had considerable experience with power reverse creeping. Go along nicely for a while and then start creeping, and crept frequently until fixed by witness, and this would not stop it permanently (R. 579-80).

(e) One occasion power reverse (Engine 2362) took away main drum pressure (R. 581).

(f) Engine 2558, Barco, went into reverse while moving forward; could not throw her ahead again. Had to take air out and cap off worm gear and use monkey wrench to move her to forward motion (R. 580). On another occasion (year 1928) with same engine witness experienced the same thing while train was going about 45 or 50 miles an hour. Could not control reverse gear at all. Discovered rod from operating lever to valve down in reversing cylinder was disconnected (2016-2021). Delayed 20 to 25 minutes (R. 580-1).

H. Proebstle, C. & N. W. (a) Has had several that would creep and kick back when hooking them up (R. 589). Has had them where they would creep over center in reverse motion if witness had not stopped them (R. 598).

(d) In 1927, unable to reverse Engine 2139 due to water frozen in air system, frozen brakes, distributing valve and both reservoirs (R. 590-1).

Frank Ellis, St. L. S. F. (a) Power reverse gear (Lewis) crept so badly on Engine 4004 that it was impossible to handle full train; it would go from center to front corner and then back again (R. 603). On Engine 1514 (E. Franklin) on three occasions gear put valve motion past center and made engine buck, necessitating reducing the speed and taking engine out of passenger train (R. 603).

(d) Witness related two instances of power reverse failing to function due to freezing, in one of which the engine had to be taken out of the train (R. 604).

J. L. Ryan, St. L. S. F. (a) The witness as Mechanical Engineer on the Frisco has experienced innumerable cases where sensitiveness of reverse gear did not respond, meaning that when you give an engine a notch to have it take the notch (R. 614).

A. Olsen, C. & N. W. (a) On Engines 2541 and 2542 had much difficulty in preventing them from creeping. Had Barco people look them over and after being repaired they would creep again (R. 620). Also experienced creeping on Engine 2499 (R. 620).

Engine 2542 (Barco gear) in January, 1928, unable to move lever. Taking hold of steam cock witness was then able to get slack and started up. Does not know why lever refused to respond (R. 622).

Witness when in pool service would generally find 9 out of 10 creeping, especially in gravel service (R. 622). On one occasion putting reverse lever in rear motion it wanted to go ahead (R. 622-3).

(f) Engine 2597 (Alco) on May 26, 1931, in going 40 to 45 miles an hour reversed itself while going down hill. Stud, nut and cotter pin were chewed off. Spring nut and the other nut came off going down Eden Hill (R. 620). Would not have occurred with manual reversed engine (R. 621 and 623).

W. B. Summers, C. & N. W. (a) Witness stated that from his experience power reverse gears creep to the entent of about two-thirds (R. 626). Engines 2541 and 2542 gave lots of trouble in that they would not respond to movement of reverse lever and would not move valve (R. 626).

(e) Unable to reach Mayfair at 5:40 A. M. due to studs breaking, necessitating remaining at Northfield for 3 hours to permit suburban traffic to pass (R. 627).

(f) Traveling at 40 miles an hour, nuts came off bottom end of reversing lever, pin came out, engine jumping into back motion and reversing itself (R. 626). Also discovered rings broken in the valve. About three or four hours' delay (R. 626-7).

S. Rasmussen, C. & N. W. (a) Having used 5 engines on four jobs, witness testified the majority of them would creep badly due to defect in packing ring (R. 633).

When engine standing still and air has been cut off the valve gear would drop down, and when pumped up again the gear came back to where it was left (R. 634).

Henry E. Blowers, C. & N. W. (a) Witness has experienced considerable creeping due to leak in piston packing; piston packing giving out and power reverse failing to respond to movement of operating lever (R. 636). Creeping on Engine 1802 caused valve motion to give out and engine went lame (R. 636). Observed engines at roundhouse when valve gear would move and air pressure was being pumped and no one in cab (R. 636-7).

In pumping engine at roundhouse witness observed that after getting about 60 or 70 pounds of steam she started for the wall of the roundhouse. Lack of sufficient steam prevented it from going through the wall (R. 637).

Charles Hintz, C. & N. W. (a) Has had occasions where gear would not stay at point of cut-off (R. 644). Had a case where engine went lame due to stuffing box on piston gland of reverse gear leaking badly (R. 644).

(f) On August 25, 1929, Engine 1662 (Alco gear) while traveling at speed of between 50 and 55 miles an hour power reverse put gear in reverse motion. Unable to find anything wrong, and easing throttle and putting gear in forward corner, she returned to normal. Ten miles farther he felt power reverse was again going into backward motion, but before it could do this he put lever down in forward motion and gear responded (R. 644-5).

O. B. Lindquist, C. & N. W. (a) Power reverse

gears creep and jump; gear fails to remain where reverse lever is set and latched; gear fails to respond when operating lever in cab (R. 647).

(b) Has observed at roundhouse when starting the pump and getting down to close up the cocks the reverse gear would start to move back and forth without anyone in the cab (R. 648).

(d) Experienced one occasion when drain cock on steam pipe to reverse gear was frozen, necessitating thawing out of drain cock and reverse cylinder (R. 648).

(f) Experienced a number of occasions where reverse gear had tendency to move back and forth when moving forward (R. 647).

C. A. JEFFERS, C. & N. W. (a) Has experienced many occasions where power reverse has crept (R. 650).

Engine 3019 on February 7, 1931, crept so badly it opened the ports wider, giving the engine more steam, causing the train to surge and pulling a drawbar (R. 651). Investigation developed a leak around the piston stuffing box gland (R. 652). Delayed 45 minutes getting rid of broken drawbar (R. 653). On Engine 3002 found rotary valve of Alco power reverse needed changing (R. 652). Delayed 25 minutes (R. 653).

On May 15, 1930, power reverse crept so badly that she raised water in the boiler. April 5, 1928, Engine 2910 crept badly entire trip of 138 miles (R. 654).

In witness' experience as fuel supervisor riding engines (5 years) he estimated 20 per cent of engines with power reverse gears would creep; although this percentage he thinks is low (R. 663).

(f) Two or three times within 30 miles Engine 3002

(Alco gear) traveling at between 60 and 65 miles an hour reversed itself, necessitating getting another engine (R. 650). Delayed 25 minutes (R. 652).

S. J. Buckner, Ill. Central. (a) Has had trouble with placing cut-off where he could handle the train (R. 669).

A. L. Sawyers, Ill. Central. (d) Witness has experienced a few occasions during cold weather when it was impossible to reverse the engine when standing out overnight account of ice and snow in power reversing gear (R. 673).

H. L. Williams, C. & N. W. (a) Number of cases of creeping on Class "J's". Witness states creeping is a regular thing (R. 674-5). If creeping could be avoided it would mean a saving of about three tons of coal per 200 miles (R. 680).

(e) Has had cases where lugs which hold operating lever would break off and let valve turn over (R. 674).

(f) Engine 2908 on October 3, 1926, went into reverse motion three times on trip from Council Bluffs to Clinton. Investigation disclosed it could not be released, even with reach rod disconnected (R. 674). Has seen a number of cases where engines went into back motion (R. 673).

(e) Engines 3004 and 3005—connection on stem which operates rotary valve was loose and had to be riveted (R. 674).

T. W. Watt, C. & N. W. (a) While running, witness has experienced power reverse creeping (R. 681).

C. W. Burkhalter, C. B. & Q. (a) Has had considerable experience with mechanism of reverse gear jumping up and down. Also when dog a little worn reverse

gear would move. Has had this trouble with majority of reverse gears (R. 691).

(d) Air reverse cylinder frozen, causing engine to slide into cab, doing about twenty or $25.00 damage (R. 691-2). Has experienced a number of occasions when air reverse was frozen (R. 694).

F. W. Heck, Ill. Central. (a) Has experienced considerable creeping (R. 696).

Geo. E. Loshbaugh, Union Pacific. (d) Frequent freezing in bad weather when oil will become hard on your links and snow and ice will accumulate there (R. 698).

John Aita, Union Pacific. (a) Has had power reverse gear creep part of the way over the road and farther you would go the more it would vary (R. 702). On one occasion power reverse gear crept so badly witness was compelled to ease off on throttle to avoid engine from damaging itself. On another occasion power reverse gear crept back and forth the full travel of the valve the last 73 miles of a 147-mile trip. Lost one hour on this run (R. 702).

Alanson Beach, Union Pacific. (a) Quite a bit of creeping in road service (R. 705).

Elmer Holmquist, Master Mechanic, C. & N. W. (a) His experience has been that power reverse requires more maintenance than hand reverse, and unsatisfactory from standpoint of controlling cut-off of the valves (R. 709). Creeping of power reverse results in waste of fuel (R. 710).

H. S. Ryder, N. Y. O. & W. (a) Has had power reverse gears which crept excessively, bucking the train back to center (R. 716).

Roy Wilkins, St. L. S. W. (a) Has had trouble with creeping of power reverse gears (R. 718).

W. G. KNIGHT, Mech. Supt., B. & Ar. (d) Also bothered by freezing (R. 722).

(e) Has one case where power reverse gear engine stripped itself, and has had broken air pipes in power reverse gears which put engine out of commission (R. 722).

H. E. TEWKSBURY, Travel. Engr. and Air Brake Inspector, B. & Ar. (a) Has known cases where power reverse has crept 3 or 4 notches while oiling around the gears (R. 729).

(f) Saw one engine start out of roundhouse, and no one in cab, when air was being pumped (R. 730).

Three or four times in last six years witness has observed steam on power reversed engines working in back motion when train was moving forward (R. 730).

J. C. MURPHY, Nor. Pacific. (a) Has had much creeping (R. 737). We had two engine failures with Precision power reverse on our division last year (R. 739).

(e) Valve ring caught a valve vibrating the reach rod so badly it knocked drain cock off of right main air reservoir, causing air to go into emergency and stopping the train; several notches were broken out of the quadrant also (R. 739).

W. J. TESCH, C. & E. I. (a) Has considerable amount of creeping on latest type Alco and Ragonnet from the time we first got the power reverse to the present time. Two new gears just installed, one in March, the other in May, began creeping two weeks after installation (R. 743).

(e) Ragonnet power reverse broke main wheel centers on both sides on six Pacific engines, creeping back to center. To overcome this these engines were changed to Alco gears and the valve lead reduced to the detriment of the engine—slowed them up (R. 744).

We also put friction blocks on the tumbling shafts on these engines which reduced the creeping to some extent but caused the reversing lever to work much harder so that it handled harder than the average hand reverse lever (R. 744).

(f) While running 50 or 55 miles an hour with Alco power gear creeping the valve gear went into back motion causing the entire engine and boiler to bounce up and down with considerable pounding and noise of different kinds so witness expected her to tear the rods off or break something (R. 745).

M. G. Love, Nor. Pacific. (e) May, 1930, Engine 2605, reverse wheel of Franklin Precision started to shake and tremble, finally throwing latch out and spinning to the corner, breaking brackets off the boiler and tearing reverse gear cylinder off, falling to the ground. Was running at 55 miles an hour (R. 751-2).

R. B. Slosson, Nor. Pacific. (a) Has experienced considerable creeping, and there are few trips you do not have it (R. 758).

(e) Has had spring break on latch on Alco power reverse (R. 758).

Edwin C. Coyle, Nor. Pacific. (a) Has experienced excessive creeping of power reverse (Alco). Has observed link block jumping two or three inches in the link, and on one occasion compelled to shut engine off account of jumping practically full length of the link (R. 767-8).

(e) While descending Helena Mountain (McCarroll Reverse Gear), pipe leading from pump to main reservoir broke off, losing all of the air on the engine.

We were on a descending grade about two miles from a siding where we were to meet another train. I im-

mediately went to work with a monkey wrench to reverse the gear, succeeding in doing so and stopping the engine 30 car lengths beyond the meeting point and seven feet from the engine of the train I was supposed to meet, that train being a little late.

If this had been hand reversed gear witness said he could have reversed the engine and admitted steam to the cylinders and have controlled the engine and stopped (R. 768).

H. Hoeft, Grt. Northern. (a) Witness' experience being mostly with Ragonnet gear he states they all creep as a general rule. His slight experience with Barco has been the same situation (R. 776).

About 1915, saw cross-head and motor on power reverse (Engine 3216) move back and forth while engine standing still and no one in car, cross-head moving 1 to 1½ inches. Engine 3384 crept so badly with Ragonnet gear that it interfered with the work of the Elesico exhaust steam injector, causing it to quit working (R. 778).

(d) On two occasions witness has had freezing of power reverse, once while standing still, the other while running. Witness testified to two other occasions of freezing while standing still, causing delay of 25 minutes (R. 776-7).

H. A. Rowe, Grt. Northern. (a) Has had considerable trouble with creeping (R. 783). Approximately one-third of his engines creep (R. 784).

(e) Has had four occasions when air supply pipe to reversing cylinders has broken off; also reach rod breaking, causing delays (R. 783-4).

Frank O'Neill, Grt. Northern. (a) Has experienced some creeping (R. 789).

(f) Engine 730 going at 50 miles an hour between Brandon and Garfield broke connecting rod, reversing engine in backward and forward motion three or four times before train was stopped. Delayed 35 minutes (R. 789-90).

T. W. INGRAM, N. & W. (a) Has fired locomotives where power reverse has crept (R. 793).

(e) Engine 1388, May 2, 1927, Columbus, Ohio, power reverse failed to reverse and went ahead instead of back, tearing main reservoir off on left side of engine (R. 792-3).

Witness said this accident could not have happened with a hand reversed gear (R. 793).

F. SCHALLER, Pennsylvania. (a) Has had a few cases of creeping badly (R. 795).

(e) Pipe between supplementary reservoir and operating valve of Alco gear broke causing passenger train of 12 cars to stop; by holding the pipe together he had fireman enabled engineer to reverse the gear and get started. If no cars had been attached to the engine the only way of stopping it would have been with the hand brake on the tender (R. 796-7).

(f) Remembers two cases due to creeping engine thrown into reverse motion causing the engine to start bucking (R. 796-7).

C. E. VERMEUL, Pennsylvania. (a) In yard service, witness has experienced creeping on a heavy drag, creeping from corner up, retarding the shoving of the train (R. 800).

C. S. RUFF, Pennsylvania. (e) January 24, 1931, Duboistown, Pa., Engine 4491, witness in giving steam the engine would not move. In throwing reverse lever ahead engine made a lurch and broke a draw head off

the tank of the engine. Cylinders were trapped full of steam. Witness testified that if this had been a hand reversed engine he could have gotten her ahead without accident (R. 806).

G. E. Hert, Pennsylvania. (a) Would creep to extent of cutting engine down (R. 807).

Wm. H. Outcalt, Pennsylvania. (e) Elizabeth, N. J., while running, supply pipe to operating reservoir of power reverse broke. We have had a number of these break due to crystallization, vibration, etc. (R. 809).

B. B. Cooksey, Southern Pacific. (a) Witness observed link block jump about 4 inches on engine standing still and no one in the cab (R. 807).

(f) Reversing gear piston failed to move and engine moved in opposite direction but witness stopped it with the brake before reaching derail (R. 815).

J. C. Harris, T. & N. O. (a) His experience has been that they creep and do not always maintain a fixed point of cut-off (R. 821).

(e) Has had cases of air pipes breaking and cases where piston would break in the key-way at the crosshead (R. 821).

A. J. Costley, T. & N. O. (a) 60 per cent or 70 per cent of the Ragonnet gears operated by witness creep as a general proposition (R. 832).

Witness has observed links moving on the old style Class "A" Ragonnet gear when locomotive was standing and no one in cab (R. 833).

E. E. LaPage, C. St. P. M. & O. (a) After hooking engine up she will gradually work down and back about an inch (R. 835).

(d) Power reverse has frozen four or five times with-

in three weeks, causing delay of between 25 and 30 minutes in each instance (R. 835-6).

J. F. FLYNN, C. St. P. M. & O. (a) Creeping is common occurrence (R. 840).

F. C. COOPER, N. Y. C. & St. L. (a) Has experienced creeping (R. 841).

(d) Has also experienced freezing with Franklin Precision and Ragonnet gears (R. 841-2). Safety latch, Franklin Precision, jumped out, causing screw gear to go full forward motion (R. 842).

R. BIERI, N. Y. C. & St. L. (a) Witness' experience with Ragonnet and Precision gears is that they both creep (R. 844).

A. W. LIEBER, N. Y. C. & St. L. (a) Witness has experienced creeping both while firing and running (R. 846).

J. J. ROSSITER, N. Y. C. & St. L. (a) Witness' experience is that power reverse gears do creep, and further stated there is not one made that does not creep (R. 847).

HARRY J. DAMPMAN, Reading. (a) Experienced trouble with creeping, and power reverse link block jumping (R. 852-3).

(d) Experienced trouble with freezing (R. 852).

EDWARD WHETSTONE, Reading. (a) Has had to place foot on back end of reach rod and hold valve at full stroke (R. 856).

(d) Witness has had power reverse lever freeze up on him (R. 857).

THOMAS HORAN, Reading. (a) Has had trouble with gear creeping (R. 861).

(d) Power reverse froze up on him twice on same

trip, consuming about 10 minutes' thawing out each time (R. 860-1).

JOHN TROUTMAN, Reading. (d) Power reverse on one occasion failed to function due to freezing (R. 862).

CHARLES E. BEECHER, Reading. (a) Creeping is a frequent occurrence; also link block moving while engine standing still (R. 863).

(d) Has also experienced freezing of power reverse, necessitating delay (R. 863).

H. L. COSPER, Wabash. (a) Has experienced power reverse gears creeping (R. 868).

(d) Unable to reverse engine due to reverse cylinder freezing (R. 868).

T. B. REDDIX, Asst. M. Mechanic, Wabash. (a) Receive numerous reports on power reverse gears floating or creeping. Many times more maintenance effort and expense is involved on power reverse than hand (R. 880). One man at Decatur roundhouse puts in all his time maintaining and repairing power reverse gears (R. 881). Inspectors from Alco gear company have inspected gears and Alco service men have had contact with the Wabash mechanics and even after following their suggestions the creeping was not eliminated. With latest type Alco gears after giving them all mechanical attention his own experts and the manufacturer's service man could devise the results have been very poor as the gears gave an enormous amount of trouble due to creeping; the Alco creeps just about the same after making repairs suggested by the manufacturer's service men (R. 881-2). The witness mentioned "numerous" work-reports on Class O engines within recent months, they being the newest engines with latest type Alco power reverse gear, and he stated they had experienced an enormous amount

of trouble due to creeping and floating of these gears (R. 881-2); at complainants' request he produced all work-reports on these engines from the time they were put in service, beginning September, 1930, to March, 1931 (R. 1169); these work-reports were produced and handed to Counsel for complainants at a subsequent hearing and in connection with them respondents introduced in evidence exhibits Nos. 60 and 61, showing the dates when each of these Class O engines was placed in service and the mileage made by each engine; also exhibit 62 showing all defects reported on these engines for October and November, 1930, and exhibits 63, 64 and 65 showing similar data for the respective months of December, 1930, January and February, 1931 (R. 1169-70). These work reports and exhibits show numerous reports on these power reverse gears with respect to "creeping" or "floating" as it is sometimes called. For example, Engine 2905 placed in service October 9th was reported November 4th, "reverse lever creeping bad," repaired, and reported again for same defect November 30th; similarly reported again January 2nd, January 4th, January 8th, January 10th, January 18th and January 23rd, the gear being repaired by skilled mechanics after each report; these reports were all of the same general effect, such as "reverse gear creeps bad—cannot work engine in proper cut-off," and definitely show the imperfection and the inefficiency of these latest type power reverse gears.

O. G. McPhail, Fuel Supvr., L. & N. (a) Witness' experience has been with Ragonnet and Alco gears, and states they both creep about 15 per cent of the time (R. 898-9).

(e) Piston broke off in the key-way where it was screwed to the cross-head of the valve gear (R. 899).

(f) Witness while riding Engine 1815 power reverse gear crept from forward to backward motion (R. 899).

L. W. PULLIAM, Travel. Engr., L. & N. (a) Has experienced some creeping. On one occasion gear crept over center so badly that engine made such a racket that if the lever had not been dropped down the engine would have stripped itself (R. 901).

A. E. WOOD, Travel. Engr., L. & N. (a) Witness stated power reverse gears creep and because of this there is an element of danger connected with them (R. 906).

W. N. SPAULDING, N. Y. N. H. & H. (a) Witness has experienced considerable creeping of power reverse gears (R. 914).

(d) Had one case where reverse gear was frozen (R. 914-5).

J. J. FITZGERALD, N. Y. N. H. & H. (a) 50 per cent of locomotives operated by witness, he states, have crept (R. 917).

(d) Same reverse gear frozen twice on same day (R. 918).

(f) Experienced one case where engine went to forward motion when reverse lever was set for backward, due to weak spring in latch (R. 918).

JAMES F. JONES, N. Y. N. H. & H. (a) Creeping of power reverse is frequent (R. 922). Witness has experienced parts of reverse gear moving while engine was standing and no one in cab (R. 924).

(e) On two occasions, different engines, the nipple which forms connection and permits air into power reverse cylinder had broken, the first case causing a delay of approximately two hours (R. 923).

EDWARD LANDERS, N. Y. N. H. & H. (d) Had experi-

enced freezing of power reverse twice on same engine. The second time it happened witness had to call for another engine, due to fact unable to thaw it out. (R. 928).

WM. E. PECTAL, N. Y. N. H. & H. (a) Witness's experience has been frequent creeping of power reverse (R. 929).

A. C. ADAMS, Supt. M. Power, Nor. Southern. (a) Witness has experienced creeping of power reverse (R. 934).

HOWARD BOBBITT, Rd. Foreman Engs., Nor. Southern. (a) Has ridden a good many engines equipped with power reverse and they all crept (R. 939).

J. H. BARKER, Western Maryland. (d) Experienced one occasion when power reverse gear froze (R. 947).

WALTER E. BUTLER, Western Maryland. (a) Power reverse gears creep, annoy and tire you out (R. 950).

Observed one case when mechanism of valve gear moved and no one in cab (R. 950).

J. H. DALZELL, Union Pacific. (a) Has not been able at all times to maintain a fixed point of cut-off; they vary some times; which witness stated was referred to as creeping (R. 1088). On the average, witness stated he reported power reverse gear creeping about once out of five or six trips (R. 1094). Experienced several occasions on the road with the Ragonett when the power reverse gear hand lever did not take effect immediately (R. 1092).

(f) On Feb. 2, 1917, Ragonett gear, witness heard a noise on right side of engine and saw air pressure going back rapidly. Slowing engine up to 3 or 4 miles an hour, witness walked beside her to place nut under driver as soon as she stopped. Walking 25 or 30 feet engine re-

versed itself and moved forward with a lunge as though she had been given steam (R. 1088).

GEORGE E. STEARNS, Union Pacific. (a) At times, witness testified he has trouble maintaining fixed cut-off due to creeping (R. 1096). The Precision screw type of power reverse gears also creep, and is much slower in direct action and precision than the hand reverse gear (R. 1100). Creeping occurs quite often (R. 1101).

W. H. BAILEY, Union Pacific. (a) With the Alco gear, which witness operates exclusively, he has experienced difficulty in maintaining fixed point of cut-off, which is ordinarily referred to as creeping (R. 1102).

(d) Had the power reverse gear freeze three times on one trip, damaging drivers before witness could get train stopped (R. 1105).

J. W. BURNETT, Asst. Gen. Supt. M. P. & M., Union Pacific. (e) Witness referred to accident testified to by Engineer Aita which occurred at Fremont, Neb., Sept. 23, 1930, when steam pipe to air pump on Eng. 2240 broke, rendering air inoperative, causing engine to collide with cars due to engineer's inability to control the power reverse gear, resulting in damage to extent of $3014.78. Witness agreed with Engineer Aita that had engine been equipped with hand reverse gear, in his opinion the engineer would have been able to stop the locomotive before striking the cars (R. 1113) and (R. 1115).

(a) Witness stated that during the last 14 years (his mechanical supervision) improvement with respect to creeping has not been made except with the Barco gear (R. 1134). Still have considerable creeping in spite of improvement in gears and packing (R. 1134-5).

B. H. CANADY, A. T. & S. F. (a) As Foreman and Asst. Foreman of roundhouse, witness stated that the reports

received regarding defects in power reverse gears were divided into four classes, viz.: oil reverse gears, pack reverse gear piston rod, reverse gears creeping, and take lost motion out of reverse gear. More reports were received on creeping than any of the others (R. 1144). The main cause of creeping is a leak in the piston rod packing (R. 1144).

C. A. Waldrip, A. T. & S. F. (a) Witness has observed power reverse gear engines creep a little bit back and forward in starting up air on the engine; he has seen the rods, links, and tumbling shaft move (R. 1154).

A. R. Rector, A. T. & S. F. (a) Has observed valve motion move, with no one in cab, a number of times. Has also seen engines move when being steamed up and without air and no one operating the lever (R. 1156). Most common cause of trouble is "creeping" due to piston packing blowing; another cause is the packing leather in reverse gear cylinder leaking (R. 1156).

W. H. Cherry, N. C. & St. L. (a) Has observed engines standing still and noticed the radius bar raise and lower with no one in the cab, which, he said, was occasioned by the packing leather leaking (R. 1167).

E. Von Bergen, Genl. Air Brake Engineer, Ill. Central. (a) Much trouble is experienced with creeping and jerking of Ragonett gears, and jerking and jumping of Precision gears. Precision gear is too slow for switching service or road service where considerable switching is performed (R. 1182-3). The manual reverse lever provides an accurate and dependable means for adjusting valve travel. The power reverse in this respect is not accurate, nor reliable, when it creeps or jumps or jerks. Has seen pistons jump while engine was standing still, jumping back and forth as much as an inch and a half (R. 1183). Witness stated his road has had cases where

locomotives ran away when they did not have any air to reverse them with (R. 1189).

J. E. Bjorkholm, Asst. Supt. M. P., C. M. St. P. & P. (a) Witness stated the power reverse gear in slow freight and yard service has functioned satisfactorily, but in fast freight and in high speed passenger service the functioning of the gear has been very unsatisfactory, due to creeping or break-downs. Because of the constant creeping of the Alco "G" type of power reverse, his company made two trial trips with engines equipped with the Barco gear, model B-4 (R. 1193).

(e) Witness had prepared statement explaining details of delays and erratic performance, etc., of power reverse gears for the year 1930, which was put in evidence as Respondents' Exhibit No. 67—Witness Bjorkholm (R. 1199).

John J. Hughes, C. R. R. N. J. (a) Witness has observed on one or two occasions in the roundhouse the valve motion move without anyone operating lever in cab (R. 1203).

E. C. Glover, A. C. L. (f) On Sept. 7, 1928, power reverse gear Engine 1553 (Ragonnet) while traveling between 55 or 60 miles an hour reversed itself. Again on the same trip it started to do the same thing but engineer caught it before it happened. However, between Wilson and Elm City, N. C., it reversed itself again. Witness stated that he had previously noticed that the valve crept on this particular engine (R. 1204-5).

E. B. Hall, Gen. Supt. M. P. & M., C. & N. W. (a) Creeping has been experienced with all types of power reverse gears. Witness further stated "that no power reverse gear has as yet been made which will give a continuous positive control of the locomotive valve that can

be depended upon under ordinary conditions of operation" (R. 1215).

JOHN NYE, D. & R. G. (a) Witness as machinist testified to repairing power reverse gears due to creeping approximately two or three a day (R. 1236). Witness has observed valve gear move when locomotive was standing and no one in the cab (R. 1236-7).

W. J. CRABBS, Western Maryland. (a) Witness stated that the various types of power reverse gears on his road (Alco, Barco, Ragonnet and Pittsburgh—R. 1241) creep, and his efforts to determine which creeps the least have not revealed much difference, if any, in them (R. 1242).

Has had cases in the roundhouse with power reversed engines when steam has developed from water lying in tubes, or from any source of leak, which has started the engine before the air pumps were on (R. 1244).

JOHN MALONEY, C. & N. W. (a) Witness stated that with power reverse gears there is more or less "shimmying", and if there is a leak at all in the air cylinder you are sure of more or less creeping (R. 1248-9).

G. A. MORIARTY, Genl. Mech. Supt., N. Y. N. H. & H. (a) From a prepared statement witness spoke of the various types of power reverse gears applied with a view to overcome creeping, but this trouble was experienced with all of them (R. 1253). While power reverse gears have been materially improved, witness stated that they are not as yet perfected, and are all subject to creeping (R. 1253).

J. E. INGLING, Genl. Supt. Fuel & Loco. Operation, Erie. (a) On the first 20 power reverse gears (Ragonnet, Type A) purchased (1911) by the Erie R. R., witness stated the creeping was exceptionally bad, stating

also that several accidents were encountered due to the valve motion not responding (R. 1264).

E. R. Gorman, Supt. M. P. & M., C. St. P. M. & O. (a) Witness stated he has many reports and complaints of engines creeping, and he has personally observed power reverse gears of every type used on his road creep (R. 1277).

(f) Power reverse gears have been responsible for a type of accident unknown prior to their application, *i. e.*, locomotives moving in the opposite direction to that indicated by the position of the reverse lever (R. 1277).

O. E. Ward, Supt. M. P., C. B. & Q. (a) From a prepared statement regarding the issues in this case, witness stated there was a tendency for power reverse gears to creep (R. 1285).

(b) With the Barco gear, the witness stated it has more or less of an erratic action, not so much as creeping, but it is pumping after an adjustment is made of the lever, meaning that it will not respond to a change of one notch on the quadrant (R. 1287).

W. P. Cunningham, Supt. M. P., Monongahela. (a) Witness introduced reports filed in his office pertaining to power reverse gears creeping (R. 1292-4).

A. B. Ford, Mast. Mechanic, Great Northern. (a) Witness stated "we have repeated complaints regarding failure of power reverse to operate properly. The principal complaint is creeping and working very close to center and in some instances going by the center and bucking train, as it is called" (R. 1303).

Frederick Kerby, Asst. to Chf. M. P., Baltimore & Ohio. (a) Witness has had many years of experience with all types of power reverse gears, and stated from his experience and reports all of these power reverse gears creep (R. 1307).

W. P. HARRIS, Norfolk & Western. (a) Has had trouble with the Ragonnet creeping and has had it go back over center. (R. 1315)

VI. UNUSUAL PERFORMANCE OF MANUALLY OPERATED REVERSE GEAR.

COMPLAINANTS' WITNESSES.

(a) Becoming unlatched; so called "going to corner."

(b) Getting away from operator.

PERFORMANCE.

FRANK STONE, C. & A. (a) Witness stated a continual rattle or pounding of reverse lever latch due to wear in each of the bearings will eventually cause the latch to drop to the corner (R. 241). In switch service witness has never had the lever jump out of the quadrant and go to the corner (R. 250).

M. J. HUNT, D. & H. (a) Has had the lever go notch by notch from the center down to the corner, but witness could not recall in passenger service that the lever jumped right out on the jump. In fast freight and passenger service witness has had the lever jump out of the quadrant and go to the corner. On yard engines has had the bar jump out of quadrant and go back and forth in the cab (R. 253).

W. A. GREENWOOD, D. & H. (a) Witness stated he has had a number of instances in approximately 30 years as an engineer where reverse levers flew out of the quadrant down to the corner due to worn part of reverse lever in the cab, or some strain in the valve motion, dry valve, tight fittings, etc. On these occasions he reduced speed, pulled lever up and went on (R. 258-9).

RAY M. DILLER, Penna. (a) Told of one instance in 14 years as an engineer, while engine was drifting down hill reverse lever unlatched and went to the corner, which, it was witness' opinion, was due to suction in the cylinders (R. 271-2).

MATTHAIS GINDER, Erie. (a) Has had dry valves but cannot recall ever having lever go to corner (R. 279).

(b) Hooking engine up at the foot of a hill witness stated several times in getting lever into a short cut-off it has gotten away from him. But he never tried opening throttle slightly before starting to hook up lever under such circumstances (R. 279).

W. T. LAWRENCE, Erie. (a) Witness stated he has experienced the lever jump out of the quadrant and go to the corner while running with a K-1 type engine of which they only have one at the present time, and this was caused because it had a quadrant with very fine notches and the latch had a tendency to work up (R. 281-3). This witness had had no experience with hand reverse gears since 1925 (R. 284). He admitted that the ordinary type of lever and quadrant with notches ½ inch wide and ½ inch or more deep would hold if a stiff enough spring were provided to hold the latch or cog in place, and if not he found an effective way to keep the latch from raising was to put a ring over the lever handle which prevented the latch lifter from raising (R. 283-4).

LINCOLN G. TANNER, B. & Me. (a) On Pacific type engines witness testified that he has experienced the lever jumping out of the quadrant, due to valve gear being tight, dry valves, tight valve rings and tight bearings on engine just out of shop (R. 285-6). Also in through passenger service witness has had the lever fly out of quadrant due to vibration, rough track, weak latch spring and lack of lubrication (R. 288). He overcame this tendency

by resting his hand on the latch lifter or screwing a monkey wrench to lever handle, and stated a stiff latch spring would hold the latch in the quadrant and perform the same purpose (R. 288).

The witness stated there would be no danger of injury if while holding the latch the lever would go to the corner as he would simply let it go (R. 289).

PATRICK FLOOD, N. Y. C. (a) Never experienced lever jumping out of quadrant on the 4-6-2 type of locomotive. But on the 2-8-2 type witness stated the lever would jump out of the quadrant only in cases of total disability of the engine. This, however, happened only on two occasions since 1905 during which time witness has operated all classes of engines with hand reverse gears, up to 250,000 pounds on drivers (R. 293). In these cases witness said it was the breakdown that caused lever to jump out of the quadrant, and this has not happened at any other time. Witness stated he had no reason to believe that this breakdown would not have happened with a power reverse (R. 294).

B. A. SNODDY, C. C. C. & St. L. (a) Has had lever jump out of quadrant a number of times (R. 296). On Engine 6147, while running at about 40 miles an hour, lever jumped out of quadrant into the corner and witness and fireman unable to pull it back at that speed. Discovered the back end of quadrant was loose (R. 297-8). Witness tightened quadrant himself (R. 298).

ELMER T. HAIRE, Mich. Central. (a) Has experienced the lever jumping out of the quadrant and going to the corner in forward movement, but not in backing up (R. 303). Witness stated it happened 3 to 6 times in yard service prior to 1917 (R. 304).

W. B. SOUTHARD, Mich. Central. (a) Witness has had experience with lever getting out of the quadrant due to

snowy weather when quadrant would become slippery, and more or less wear in the bearings and connections, or dry spell or a rough valve chamber wall (R. 305-6).

J. R. PRICE, C. & O. (a) "About the only trouble I ever had with the lever jumping out of the quadrant is when we are working water pretty bad", which dries the engine, causing reverse bar to work hard (R. 309). Knowing the lever may jerk when valves are dry witness braces himself accordingly and if it jerks lets it go forward and keeps his legs, hands and arms away from in front of it (R. 310).

A. K. PEARCE, S. A. L. (a) On one occasion while running the eccentric strap broke and the lever went from one end of the quadrant to the other until the engine practically stopped. Witness could not recall any other occasion, but stated he has had them a long time ago (R. 311).

J. L. STAKEMAN, C. & E. I. (a) Witness stated "they have jumped out of the quadrant but I can't tell the incidents nor the time. It has been some time ago" (R. 313). He said it would average jumping out as much as once a year during his 46 years experience; on those occasions he slowed down the engine and pulled the lever back (R. 315).

OWEN HOWARD, B. & O. (a) Witness has had the lever jerk and pull out of his hands. He doesn't let them take him to the corner, too. He lets loose and lets her go (R. 317). This would be occasioned by dry valves or some defective mechanical condition (R. 319).

J. H. AUSTIN, S. & A. (a) Witness has had experience of lever jumping out of the quadrant due to dry valves and worn parts of the link motion and reversing gear (R. 321). On Engine 114 lever jumped out of the quad-

rant and went to the corner, breaking a valve yoke (R. 322). On the 80,000 pound engines, witness was not sure about the lever jumping out of the quadrant (R. 323). Several years ago (R. 326).

H. G. WILLIAMS, C. & N. W. (a) "When you have your engine hooked up it is a common thing for a lever to jump and go down into the corner if she is going in forward motion. I have never experienced it flying out going back" (R. 328).

ARTHUR R. RUDOLPH, C. & N. W. (a) Witness stated he has had the lever jump out of the quadrant and go to the forward corner. This is usually due to vibration at high speed, dry valves, worn bearings, quadrant and latches. This condition is known by vibration of lever and witness hold latch to prevent it—never injured so doing (R. 337-8).

L. J. LARSEN, C. & N. W. (a) Has had the lever go to forward corner (R. 344).

(b) On one occasion, Dec. 24, 1927, in adjusting lever two notches back it slipped down about 4 notches and latch caught in the quadrant; after unlatching it witness and fireman could not hold it and it went into full gear (R. 344). This is the only time witness has experienced this situation (R. 346).

J. R. ADAMS, Wabash. (b) Witness has had the lever get away from him at times, but could not recall any particular time (R. 353).

WM. A. GARMAN, St. L. S. F. (a) Has experienced the lever jumping out of the quadrant when he was not attempting to hook it up, and going to the corner (R. 362).

J. M. CRUM, C. B. & Q. (a) On a return trip from Kansas City, when witness unlatched the lever it went to the corner (R. 365). On another occasion, with an-

other engine, witness experienced the same occurrence, due to oil that got on the quadrant (R. 366).

C. B. KINNAIRD, L. & N. (a) Witness has had the lever jump out of the quadrant due to badly worn pins, counterbalance not being properly adjusted, or dry valves (R. 386).

JAKE PASCHALL, L. & N. (a) While hooking up engines witness has had the lever get away from him and jump into the front end corner. Witness stated that just recently he had occasion to assist the engineer when he heard the reverse lever back against the front end of the quadrant (R. 390).

J. B. POOL, C. R. I. & P. (a) Witness stated that during his experience of 25 years on locomotives he has had the lever jump out of the quadrant and go to the corner several times (R. 401) due to leaky dry pipe etc. which was promptly remedied when reported (R. 403). Witness described an incident which he saw happen to another engineer when in attempting to hook an engine up he was thrown to the floor and his breath knocked out (R. 401). This happened in 1914 or 1915; the engineer was 70 years old and ready to retire (R. 404).

NICK W. BRANDT, C. & W. I. (a) Has had several occasions when in letting the reverse lever down it got away from him and went to the corner (R. 418).

RESPONDENTS' WITNESSES.

J. E. GELDBAUGH, B. & O. (a) Never had a case where hand operated reverse lever became unlatched and went to the corner (R. 426).

(b) Does not recall any occasion when, after unlatching the hand lever, he was unable to keep hold of it (R. 426).

T. W. Pugh, B. & O. (a) Witness stated he has had things of this sort happen with the old slide valve, and it has been 15 years since he has run that class of engine (R. 444).

(b) Never experienced the hand lever pulling away from him after it was unlatched (R. 445).

Junior B. Fraley, B. & O. (a) Never experienced lever unlatch and go to the corner (R. 455).

Roy Fraley, B. & O. (a) Never saw lever jump out of quadrant on Johnson bar type and go to the corner (R. 471).

R. Brotherton, B. & O. (a) Has never had lever become unlatched and go to the corner (R. 483).

(b) Never experienced lever on hand gear pull away from him after unlatching (R. 483).

R. C. Schraffenger, B. & O. (a) On one occasion witness stated the lever "jumped out of the quadrant." The lever "crawled down toward the corner as the latch raised and would then catch again." This was due to the front end or quadrant being low which was corrected. This was the only time he could recall. Had never seen lever go to corner with a bang (R. 497).

(b) Has never had the experience of the lever pulling away from him after it was unlatched (R. 497).

L. G. Route, B. & O. (a) Only on one occasion has witness experienced lever unlatch and go to the corner (R. 510).

B. F. Freeland, B. & O. (a) Experienced 3 or 4 occasions when reverse bar went down into corner (R. 525).

James A. Ward, B. & O. (a) Has had reverse lever go to the corner. The last time this happened, however, was between 1908 and 1911 (R. 540).

DANIEL F. CROWLEY, Illinois Central. (a) Witness has experienced the lever jumping out of quadrant and going to the corner only once, this occurring six months ago (R. 549).

C. P. MCCASKILL, Illinois Central. (a) Only had one case of lever jumping out of quadrant and going to the corner (R. 553).

G. C. BUELL, Illinois Central. (a) Lever jumped out of quadrant and went to the corner only once during his entire service, due to too much oil and set screw where dog goes through causing the lever to rock a little bit (R. 555).

(b) Never had any trouble with lever pulling away after unlatching (R. 555).

W. K. RUST, Illinois Central. (a) Never experienced the lever jumping out of quadrant (R. 558).

(b) Has had the lever drop down once or twice, a number of years ago (R. 558).

ERNEST C. RICHTER, C. & N. W. (a) Never has had hand lever slip or pull away (R. 561).

(b) Nor has witness experienced hand lever jump out of quadrant (R. 560).

CHARLES S. THORP, C. & N. W. (a) Experienced but one occasion when lever jumped out of quadrant and went to the corner, due to some one's carelessness in filling lubricator and allowing oil to accumulate and get on quadrant (R. 574).

H. HERRICK, C. & N. W. (a) Never experienced hand lever jumping out of quadrant and going to the corner (R. 579).

(b) Has never had hand lever pull away from him (R. 579).

H. Proebstle, C. & N. W. (a) Had one experience of reverse lever becoming unlatched and going to the corner (R. 589).

(b) Witness has never had hand lever pull away from him (R. 589).

Frank Ellis, St. L. S. F. (a) During his 17 years as an engineer witness stated the lever unlatched and went to the corner not more than three times (R. 605).

A Olsen, C. & N. W. (a) Had one experience when lever unlatched and went forward about three notches (R. 620).

(b) Never experienced the lever pulling away from him (R. 620).

W. B. Summers, C. & N. W. (a) Never has experienced hand lever becoming unlatched of itself and going to the corner (R. 625).

S. Rasmussen, C. & N. W. (a) Had two occasions—same engine, same day—when lever unlatched and went to the corner due to a defective latch (R. 633).

(b) Does not recall any instance when the lever pulled away from him (R. 633).

Henry E. Blowers, C. & N. W. (a) Has never experienced the lever becoming unlatched and going to the corner (R. 635).

F. C. Meyer, C. & N. W. (a) Never had lever unlatch and go to corner (R. 638).

(b) Never had it get away from him (R. 638).

Charles Hintz, C. & N. W. (a) Can recall but one instance of hand lever becoming unlatched and going to the corner, due to snow in the cab and engine covered with snow and ice, and worn condition of quadrant and latch (R. 643-4).

(b) Experienced two occasions when lever pulled away from him (R. 644).

O. B. LINDQUIST, C. & N. W. (a) Never experienced lever unlatching and going to corner (R. 647).

(b) Nor getting out of his control (R. 647).

C. A. JEFFERS, Fuel Supvr., C. & N. W. (a) Has never had the lever jump out of the quadrant, but has had it go to the corner because of some broken part (R. 650).

J. R. FIELDS, Ill. Central. (a) Has never experienced lever unlatching and going to the corner (R. 666).

(b) Nor did lever ever pull away from him (R. 666).

W. J. DOOLITTLE, Ill. Central. (b) Has occasionally had the lever slip loose from him and go to the corner, due to worn notches and too much oil on them (R. 668).

S. J. BUCKNER, Ill. Central. (a) Lever jumped out of quadrant and went to the corner on just one occasion (R. 669).

(b) Never had lever pull away from him (R. 669).

H. R. SPIKES, Ill. Central. (a) Has had the lever jump out of quadrant and go to the corner due to worn latch (R. 671).

T. W. WATT, C. & N. W. (a) Has never experienced hand lever unlatching itself and going to corner (R. 681).

(b) Neither has witness ever experienced the hand lever pulling away from him after unlatching (R. 681).

E. G. BATES, C. & N. W. (b) Has never had hand lever pull away from him after unlatching (R. 684).

C. W. BURKHALTER, C. B. & Q. (a) Witness stated he has never had a hand lever fly out of the quadrant and go to the corner (R. 690-1).

GEO. E. LOSHBAUGH, Un. Pacific. (a) Had just one experience of lever getting out of quadrant and going to the corner (R. 697).

(b) Has never had lever get away from him (R. 697).

W. S. BEACH, Un. Pacific. (a) Has never experienced lever getting out of quadrant and going to the corner (R. 700).

(b) Neither has he experienced lever pulling away from him (R. 700).

JOHN AITA, Un. Pacific. (a) Has never had lever get out of quadrant and go to corner (R. 701).

(b) Has never experienced lever getting away from him when hooking up or letting down (R. 701).

ALANSON BEACH, Union Pacific. (a) Never had one go to the corner (R. 705).

(b) Never had one get away from him (R. 705).

H. S. RYDER, N. Y. O. & W. (a) Has never had a lever become unlatched of its own accord and go to the corner (R. 716).

J. H. CURTIS, B. & Ar. (a) From his observation and experience witness has never observed nor had the occasion himself of the lever unlatching and going to the corner (R. 726).

(b) Nor has witness had the lever pull away or observed this with other engineers (R. 726).

W. J. TESCH, C. & E. I. (a) Has never had or seen lever unlatch itself and go to the corner (R. 742).

(b) Nor has witness ever had or seen the level pull away (R. 742).

W. V. RYAN, N. Y. C. (a) Witness never saw one unlatch itself (R. 749).

(b) Never saw one get beyond the control of the man (R. 749).

M. G. Love, Nor. Pacific. (a) Has never had hand lever jump out of quadrant of its own accord and go to corner (R. 751).

R. B. Slosson, Nor. Pacific. (a) Never had the hand lever unlatch and go to the corner (R. 756).

(b) Has never experienced hand lever pull away from him after unlatching (R. 756).

Edwin C. Coyle, Nor. Pacific. (a) Has never experienced hand lever unlatch and go to the corner (R. 767). Dry valves will cause lever to rattle but have never in his experience caused the latch to raise; latch has always remained firmly seated in quadrant (R. 769).

(b) Neither has he ever had hand lever pull away or get beyond his control (R. 767).

Geo. W. Johnson, Nor. Pacific. (a) Has never experienced hand lever unlatching and going to the corner (R. 772).

(b) Nor has he ever had hand lever pull away or get beyond his control (R. 772).

H. A. Rowe, Grt. Northern. (b) Has never had the hand lever pull away or get beyond his control (R. 783).

B. B. Cooksey, Southern Pacific. (a) Has had no experience with hand lever unlatching and going to the corner (R. 814).

(b) Has had no experience of letting go of latch (R. 814).

J. C. Harris, T. & N. O. (a) Does not recall any case where lever unlatched and went to the corner (R. 820).

(b) Has never had it get away from him, nor does he recall any case as to others (R. 820).

A. J. COSTLEY, T. & N. O. (a) Never at any time experienced lever unlatching and going to the corner (R. 832).

(b) Nor has witness ever had lever get beyond his control (R. 832).

E. E. LAPAGE, C. St. P. M. & O. (a) Has never had the occurrence of lever unlatching and going to the corner (R. 835).

(b) Nor has witness ever had the lever get beyond his control (R. 835).

J. F. FLYNN, C. St. P. M. & O. (a) Never had an occurrence of lever unlatching and going to the corner (R. 840).

(b) Nor has lever ever got beyond his control (R. 840).

R. BIERI, N. Y. C. & St. L. (b) Has never had hand reverse lever get away from him (R. 843-4).

EDWARD WHETSTONE, Reading. (a) Never experienced hand bar jumping out of quadrant.

(b) Has never had the hand bar jump out of his hand (R. 856).

THOMAS HORAN, Reading. (a) Has never experienced the hand bar jump out of the quadrant (R. 860).

(b) Nor has witness ever had the hand bar jump out of his hand (R. 860).

CHARLES E. BEECHER, Reading. (a) Has never had the hand bar jump out of the quadrant (R. 863).

(b) Nor has witness ever had the bar get out of his hand (R. 863).

H. L. COSPER, Wabash. (a) Has never experienced

the hand lever becoming unlatched and going to the corner (R. 866).

(b) Has never experienced, nor has he observed, the hand lever getting away from him or others (R. 866).

W. G. DICKHAUT, N. Y. C. (a) About 1910, witness had one experience of lever jumping out of quadrant of its own accord, due to smooth teeth in quadrant. Does not have same type of quadrant now (R. 886).

(b) Has never had the hand lever get away from him (R. 886).

JESSE TRAYLOR, L. & N. (b) Witness has never observed a reverse lever get away from an engineer (R. 888).

W. N. SPAULDING, N. Y. N. H. & H. (a) About 15 years ago, on a saturated engine, witness had the lever, after unlatching, drop down a few notches, but never to the corner (R. 912).

JAMES F. JONES, N. Y. N. H. & H. (a) Had one experience in 1921, when the hand lever started to unlatch and witness held it until he got in. This was due to the quadrant and dog being pretty well worn, and the fireman permitted the quadrant to get all wet (R. 920).

EDWARD LANDERS, N. Y. N. H. & H. (a) Has never had the lever jump out of quadrant and go to the corner (R. 927).

(b) Has never been pulled by lever nor at any time was it beyond his control (R. 927).

WM. E. PECTAL, N. Y. N. H. & H. (a) About 7 or 8 years ago, witness had one experience of hand lever unlatching itself and going to the corner (R. 928-9).

(b) Has never had lever get beyond his control (R. 929).

HOWARD BOBBITT, Norfolk Southern. (a) Has never

known of a hand lever to jump out of the quadrant (R. 939).

WALTER E. BUTLER, Western Maryland. (a) Has never had the hand lever unlatch and go to the corner (R. 949).

(b) Has never had it get away from him while he was handling it (R. 949).

J. H. DALZELL, Union Pacific. (b) Never had any difficulty in maintaining a fixed point of cut-off (R. 1088).

GEORGE E. STEARNS, Union Pacific. (b) Never experienced any difficulty in maintaining a fixed point of cut-off (R. 1096).

W. H. BAILEY, Union Pacific. (b) Always able to maintain a fixed point of cut-off (R. 1102).

J. W. BURNETT, Asst. Genl. Supt. M. P. & M., Union Pacific. (a) Witness stated he never observed an engineman having difficulty adjusting hand reverse gear to proper cut-off while engine was in motion; and has never had called to his attention or known of hand reverse gear jumping out of quadrant and going to forward motion when engineer endeavoring to adjust cut-off (R. 1110).

E. VON BERGEN, Genl. Air Brake & Car Heating Engr., Illinois Central. (a) Has had a few cases of lever unlatching itself and dropping to full stroke forward position. Among other reasons for this, witness stated notches in quadrant or dog worn so lost motion permitted excessive vibration; also foaming boilers washing lubrication off valves (R. 1180-1).

(b) When lever unlatched and got away from him, witness stated he experienced no danger to himself or to others (R. 1181).

E. C. GLOVER, A. C. L. (a) Witness stated that dur-

ing the last 12 years of running he has had the lever come unlatched and go to the corner approximately 25 times or more, but this would always be due to some defect (R. 1207).

E. B. Hall, C. & N. W. (a) Witness stated that during his entire experience in riding locomotives, he has never observed a hand lever jump out of the quadrent, nor could he recall ever having seen it pull or get away from the man operating the locomotive he was riding. Witness conceded, however, that these things do happen, but their occurrences are infrequent (R. 1213).

John Maloney, C. & N. W. (a) Witness did not recall that the lever became unlatched and went to the corner (R. 1246).

(b) Nor did he ever have one pull away or get beyond his control (R. 1246).

A. B. Ford, Master Mechanic, Great Northern. (a) During witness' entire experience as an engineer (1896-1901) he could not recall an instance when lever unlatched and went to the corner (R. 1201).

(b) Nor could he recall any instance when hand lever got away from him (R. 1301).

VII. Decreased Efficiency and Economy in Locomotive Operation with Power Reverse Gear.

complainants' witnesses.

(a) Effects of Creeping.

(b) Opinions of Witnesses.

H. G. Williams, C. & N. W. (a) Creeping causes use of more coal and water (R. 331).

COMPLAINANTS' REBUTTAL WITNESSES.

RALPH R. DAVIS, Great Northern. Does not recall any instance in which Engine 3063, being a Mikado engine equipped with power reverse gear, consumed more coal than usual on account of the action of the gear (R. 1332).

H. W. MIDDAUGH, Northern Pacific. Witness not in a position to say whether an improper working power reverse gear increases fuel consumption, because he has had no such experience (R. 1334-5).

JOHN I. WAY, Baltimore & Ohio. On the average, has not lost any time or burned an excessive amount of fuel caused by the performance of the power reverse gear (R. 1339). So many factors enter into the question he is unable to state definitely what effect power reverse gears have on fuel consumption (R. 1340).

J. P. MEAGHER, C. & E. I. In reciting various conditions which would affect the consumption of coal, witness stated that if the gear was creeping it would cause increased consumption (R. 1342).

JAMES MCKEANEY, Reading. Witness was asked what his experience had been in respect to creeping causing a waste of fuel and Witness Dampman's statement that the creeping caused such a waste. Witness replied that he never found creeping enough to make any difference (R. 1343).

A. J. SEELMAN, C. B. & Q. Has not noticed that power reverse made any difference in the coal pile (R. 1347). Has had to take extra coal because of cold weather and heavy handling of trains but not because of power reverse gear creeping (R. 1347). He added that the amount of coal used might be affected by other conditions as well as creeping and so would not be able to tell how much was due to creeping of power reverse gear

(R. 1347-8). He could not recall a trip when the same tonnage, weather conditions, wind and other factors were equal and the only unusual circumstances was that the power reverse gear crept on one trip and did not on the other (R. 1348).

D. HARTLE, Baltimore & Ohio. Excessive creeping of power reverse would have an effect on the amount of fuel used. Has never observed such conditions (R. 1351).

R. L. ACKER, N. Y. N. H. & H. R. R. Witness was questioned as to the statement of Witness Jones that creeping increased the consumption of coal. He replied that there were other conditions, such as wind and weather, which caused increased consumption (R. 1356). He added that the creeping he had experienced was not enough to cause any great amount of difference in the fuel used (R. 1356). He did not undertake to say, however, that Witness Jones did not have exactly the experience concerning which he testified.

L. P. GOLSON, Illinois Central. Has had very little creeping and never noticed that what trouble he had of this character caused increased coal consumption (R. 1368).

E. W. ERISMAN, Wabash. Has not noticed on the occasions when the power reverse gear crept by looking in the tender that more coal was consumed but is of the opinion that with creeping you use more coal. However, the engineer has no actual record of what that may be (R. 1375).

M. M. JOHNSON, C. & N. W. Has had very little creeping. He did not notice that he used any more coal because of the creeping. Admitted he made no particular observation as to fuel consumption on those occasions (R. 1391).

W. H. CALAME, Union Pacific. Has had very little creeping and then the equivalent of a notch or two. Has never noticed increased consumption of fuel due to creeping (R. 1393).

RESPONDENTS' WITNESSES.

J. E. GELDBAUGH, B. & O. (a) Hard on water, steam and coal (R. 427). Creeping gears affect freight trains, and especially fast freights (R. 427).

(b) A locomotive on which proper cut-off can be maintained would be more economical than one on which it cannot. Witness stated throughout his entire experience he has always been able to maintain proper cut-off with hand reverse gear (R. 428); but experienced frequent creeping with power reverse gears (R. 426-7, R. 434-5, Ex. 109).

T. W. PUGH, B. & O. (a) Creeping causes engine to become lame and prevents it from doing work properly; valve motion would creep in both directions (R. 445). Would have effect of dragging train harder, jerking it somewhat (R. 453).

(b) Witness' experience has been that the manual gear burns less coal and uses less water than the power reverse, and that the manual gear stayed put much better than the power reverse (R. 446).

JUNIOR B. FRALEY, B. & O. (b) For efficiency of operation and saving of fuel and water, witness stated he would prefer the hand reverse (R. 458-9).

ROY FRALEY, B. & O. (b) The hand gear from standpoint of efficiency is much better than the power reverse, but if power reverse did not creep it would be just as good as any other (R. 474).

R. C. SCHRAFFENGER, B. & O. (a) When it goes down

towards the corner it burns quite a bit more coal and uses more water, and you cannot make speed (R. 498).

(b) If hand reverse hooked up you get same cut-off as long as you want it. With power reverse that creeps would be in corner part of time and nearly cut out part of the time (R. 498).

L. G. Route, B. & O. (b) Witness believes the hand gear the more efficient, there being no lost motion, nor creeping (R. 512). From witness' experience with power reverse gears they use approximately 25 per cent more coal than manual gear (R. 518).

James A. Ward, B. & O. (a) Effect of creeping is to consume more fuel and water (R. 541).

(b) Hand operated gear is more efficient (R. 541).

C. P. McCaskill, Ill. Central. (b) Manual reverse will stay where you put the lever. Power reverse handles hard out of shop and has to be broken in same as manual (R. 554).

W. K. Rust, Ill. Central. (a) Most efficient results are with manual reverse gears (R. 558).

Ernest C. Richter, C. & N. W. (b) Witness explained he can operate a hand lever locomotive more economically than the air reverse lever (R. 564). With hand reverse he knows at all times what his engine is doing, but with air reverse he never knows (R. 563).

H. Herrick, C. & N. W. (b) If power reverse is not creeping and working all right, no difference between that and manual. But if creeping, it is not nearly as economical as hand reverse (R. 583).

H. Proebstle, C. & N. W. (b) With creeping lever point of cut-off is moved from various positions, whereas with hand reverse the lever stays put (R. 594). Man-

ual reverse remains at a desired point of cut-off, thereby saving fuel and water (R. 597).

FRANK ELLIS, St. L. S. F. (a) After power reversed engine been out of shop for some time, or some time has elapsed since it was overhauled, gear will develop a certain amount of lost motion (R. 604).

A. OLSEN, C. & N. W. (a) The hand lever will stay where you put it, and power reverse as a rule will creep if not in good shape (R. 623).

W. B. SUMMERS, C. & N. W. (a) Would tear the fire, hard on pins and bushings and driving blocks (R. 626). On one occasion Engine 2911 crept so badly that witness was hardly able to handle the train; she would work engine hard and jerk the train (R. 627).

(b) If air reverse did not creep there would be no difference between them, but when it creeps it uses more coal and efficiency of engine is not so great (R. 627).

HENRY E. BLOWERS, C. & N. W. (a) Creeping has effect of working engine harder than witness desires, and other times would not work as hard as he wanted it to (R. 636).

(b) From an economical viewpoint, witness prefers the hand reverse lever (R. 637).

O. B. LINDQUIST, C. & N. W. (a) If lever goes too far engine is working at longer point of cut-off than desired, and if happening the other way goes over center and into back motion (R. 647). Movement back and forth of cross-head necessitated the burning of more fuel and use of more water (R. 647).

C. A. JEFFERS, C. & N. W. (a) Effect of creeping is to burn an unusual amount of fuel (R. 655). Engine 2910, April 5, 1928, due to creeping used an excessive amount of fuel (R. 654-5).

(b) Hand operated gear more economical and more efficient (R. 660).

H. L. Williams, C. & N. W. (a) Received complaints as result of creeping engines burning too much coal (R. 674-5).

(b) With hand lever you can control point of cut-off, whereas with power reverse when creeping you use more coal and water (R. 676).

E. G. Bates, C. & N. W. (b) Sees no advantage in putting on power reverse (R. 684).

C. W. Burkhalter, C. B. & Q. (b) Power reverse gear hard on fireman's back, as well as on coal and water, and can do better work with hand reverse (R. 693).

John Aita, Union Pacific. (a) Effect of creeping necessary on one occasion to make extra stop for water, and burned three to four tons of coal more than ordinarily (R. 702).

Alanson Beach, Union Pacific. (a) Effect of creeping has been to burn from three to five tons more coal over the Division than when it is not creeping; also affects consumption of water (R. 705).

H. S. Ryder, N. Y. O. & W. (a) Creeping has the effect of causing excessive fuel and water consumption (R. 716).

(b) Witness' opinion is that hand reverse is more efficient (R. 716).

Roy Wilkins, St. L. S. W. (a) When power reverse is creeping it uses more fuel and water (R. 719).

H. E. Tewksbury, Travel. Engineer & Air Brake Insp., B. & Ar. (a) Effect of creeping is to consume more fuel (R. 734).

J. C. MURPHY, Nor. Pacific. (a) Creeping in addition to causing extra consumption of fuel and water, has had effect of causing engine to prime and foam; would also affect valve movement of taking lubrication away (R. 738).

W. J. TESCH, C. & E. I. (b) Hand reverse lever is much more efficient and economical (R. 745).

R. B. SLOSSON, Nor. Pacific. (b) Prefers hand reverse gear (R. 759).

EDWIN C. COYLE, Nor. Pacific. (b) States the hand lever is better (R. 768).

H. HOEFT, Grt. Northern. (a) Creeping has the effect of consuming more coal (R. 778).

(b) States the hand reverse is better (R. 779).

H. A. ROWE, Grt. Northern. (a) Effect of creeping causes use of more coal and water, also losing time (R. 784).

(b) Hand lever more efficient (R. 785).

FRANK O'NEILL, Grt. Northern. (a) Creeping causes an uneven movement of train (R. 790).

(b) The hand reverse lever is more economical (R. 790).

T. W. INGRAM, Nor. & Western. (a) Burn more coal and more difficult to maintain a fire when power reverse is creeping (R. 793).

(b) Hand operated gear more economical (R. 793).

F. SCHALLER, Pennsylvania. (a) Makes it difficult to maintain schedule; hard on fire and water (R. 795-6).

(b) Prefers hand screw reverse gears (R. 797).

G. E. HERT, Pennsylvania. (a) Creeping has effect

of working engine further down than would be necessary otherwise (R. 808).

(b) Hand reverse more efficiently operated than power reverse (R. 807).

D. H. JENNESS, Pennsylvania. (b) Hand lever and screw reverse gears are more efficient (R. 810).

J. C. HARRIS, T. & N. O. (a) Has effect on fuel and water consumption (R. 821).

(b) Hand reverse gear more efficient (R. 822).

A. J. COSTLEY, T. & N. O. (a) Creeping has the effect of causing engine to work harder (R. 832).

E. E. LAPAGE, C. St. P. M. & O. (a) Creeping causes engine to work harder (R. 835). Also increases fuel consumption (R. 839).

(b) The hand reverse is away ahead of power reverse so far as economy goes (R. 836).

J. F. FLYNN, C. St. P. M. & O. (a) Effect of creeping causes jerking with a light train, and burning more coal (R. 840).

F. C. COOPER, N. Y. C. & St. L. (a) Creeping has a tendency to use more coal and water (R. 842).

R. BIERI, N. Y. C. & St. L. (a) Effect of creeping prevents getting proper cut-off and a tendency to use more coal and water (R. 844).

J. J. ROSSITER, N. Y. C. & St. L. (a) As result of two tests with a nearly new latest type Precision power reverse gear, on one trip with creeping gear, the other when gear did not creep, it is shown that creeping gears cause the burning of more fuel and use of more water. Weather and wind conditions were approximately the same; had same engine crew; same number of cars and

34 tons more on latter trip; moved over same division 114 miles in same direction on each of these two trips; weighed the coal in tender both before and at finish of trip in each case; and found they used 5,000 pounds more coal on the trip when the gear was creeping (R. 847-8).

HARRY J. DAMPMAN, Reading. (a) Creeping causes waste of fuel and is very annoying, breaking up harmony in the cab (R. 852-3).

THOMAS HORAN, Reading. (a) Account of creeping you cannot obtain desired cut-off, and it is harder on coal and water (R. 861).

H. L. COSPER, Road Foreman of Engines, Wabash. (a) Creeping is hard on fire and causes waste of fuel (R. 869).

(b) The hand gear is superior to the power reverse gear due to the fact of creeping of the power reverse (R. 869).

T. B. REDDIX, Asst. Mast. Mechanic, Wabash. (a) In witness' opinion, creeping will cause a greater consumption of fuel (R. 885).

W. G. DICKHAUT, N. Y. C. (a) Has effect on fuel and water consumption (R. 887).

JESSE TRAYLOR, Traveling Engr., L. & N. (a) Causes the burning of more fuel, and at times undesirable slack action in the train (R. 889).

W. N. SPAULDING, N. Y. N. H. & H. (a) When power reverse gear is creeping engine uses more coal (R. 915).

J. J. FITZGERALD, N. Y. N. H. & H. (a) With creeping reverse gear witness stated engine was required to use at least one-third more coal (R. 917).

(b) Manual reverse is positive and you never have any waste (R. 918).

JAMES F. JONES, N. Y. N. H. & H. (b) No question whatever but that hand reverse is more economical (R. 924).

WM. E. PECTAL, N. Y. N. H. & H. (a) Creeping power reverse has effect upon the fire and causes consumption of more coal (R. 929).

HOWARD BOBBITT, Nor. Southern. (a) Has tendency to lower the link or valve motion in direction engine is moving, and increases consumption of coal (R. 940).

WALTER E. BUTLER, Western Md. (a) Creeping consumes more coal, water and lubrication (R. 950).

(b) Hand reverse gear more economical with respect to consumption of fuel (R. 951).

J. H. DALZELL, Union Pacific. (a) With creeping gears you do not maintain an even cut-off and burn considerably more coal. Witness stated he has kept records to substantiate this contention (R. 1091).

GEORGE E. STEARNS, Union Pacific. (a) An engine that is creeping you cannot hold her to her cut-off, and it burns more coal, consumes more water, and tears the fire to pieces all the time (R. 1096).

J. W. BURNETT, Asst. Gen. Supt. M. P. & M., Union Pacific. (a) In connection with factors tending to increase expense and adversely affect operation of locomotives, consideration must be given to losses resulting from defective power reverse gears which render gears ineffective for proper handling of locomotives and result in excessive fuel consumption due to inability to maintain fixed point of cut-off. No power reverse gear has as yet been perfected to a point where it is positive

and will not creep (R. 1116). Power reverse gears were installed on locomotives of Union Pacific not because they were more economical, efficient, or safer to operate, but because they lessened the burden of the engineer's work to some extent (R. 1117).

(b) "There has not been a power reverse gear put on the market up to date that is reliable at all times" (R. 1116). The hand reverse gear is always reliable and available as a means of controlling movement of train in case of air failure or breaking of air pipes which results in loss of air on the locomotive (R. 1116).

E. Von Bergen, Genl. Air Brake & Car Heating Engr., Illinois Central. (a) Creeping causes waste of fuel, and interferes with maximum speed (R. 1183).

(b) So far as economy of operation is concerned, witness stated he did not know of any case where the power reverse gear was more economical or provides a better operation. So far as safety is concerned, that is relative (R. 1184). In actual practice with respect to power reverse gears, there is no economy at all. The only increase in efficiency is on those locomotives where the design was such that it was impracticable to continue the manual reverse lever (R. 1185).

J. E. Bjorkholm, Asst. Supt. M. P., C. M. St. P. & P. (a) Creeping gears naturally affect fuel consumption materially (R. 1200).

(b) The inefficient operation of the power reverse gear results in inefficient operation of the locomotive (R. 1200).

E. B. Hall, Genl. Supt. M. P. and M., C. & N. W. (a) Witness agreed with Fuel Supervisor of his road that creeping power reverse gears increased fuel consumption about 20 per cent (R. 1224).

(b) Witness stated that power reverse gears "cost

more to maintain, and we have not benefitted by more economical locomotive performance or saving in fuel by reason of this equipment, nor have we experienced any greater efficiency as regards the amount of work done per locomotive by application of these power reverse gears'' (R. 1215).

W. J. Crabbs, Western Maryland. (b) From his general information and contact, witness stated he was aware of no economies resulting to his railroad as result of the application of power reverse gears (R. 1241).

John Maloney, C. & N. W. (a) Creeping is hard on the draft gear, jerking the train, affecting the exhaust, the fire, and everything else (R. 1249).

G. A. Moriarty, Gen. Mech. Supt., N. Y. N. H. & H. (a) The manually operated reverse gear, witness stated, gives a more permanent, positive and closer adjustment of cut-off resulting in less consumption of fuel (R. 1255).

(b) Witness stated he did not believe that locomotives equipped with power reverse gears could be operated with as economical a fuel consumption as one equipped with hand reverse lever (R. 1253).

J. E. Ingling, Erie. (a) Effect of creeping is to increase fuel and water consumption (R. 1266).

George M. Boh, Dist. Rd. Foreman & Fuel Supervisor, Erie. (a) Witness, on March 20, 1930, stated that some dynamamotor tests were made on a Lewis power reversed engine (Eng. 3200) from Buffalo to Hornell, N. Y. (92 miles) with a view to determine whether it would pay to put on booster-equipped locomotives. The test developed that the value gear was creeping. Witness found this was caused by the reverse gear

creeping due to a screw in the gear cylinder bushing which could not be detected by ordinary inspection; in fact the repair man had had the gear cylinder heads off a couple of times and examined the packing and failed to find it (R. 1268). After gear was corrected, a succeeding trip was made with the same train, same number of cars, same schedule, and as nearly as possible the same tonnage. This test developed—after gear was repaired—a decrease in fuel consumption of 3,800 pounds for a 92-mile trip (R. 1268).

E. R. GORMAN, Supt. M. P. & M., C. St. P. M. & O. (a) Creeping prevents proper and correct regulation of the valve travel or cut-off, and results in excessive fuel consumption (R. 1277).

(b) From 1915 to date, while in service as Trainmaster, Asst. Supt., and Supt. of Motive Power & Machinery, witness has ridden and operated locomotives very frequently equipped with manual and power reverse gears of the Melline, Ragonnet, Lewis and Alco types, and stated he has yet to see the hand operated reverse gear that cannot be manipulated without liability of injury, or the power reverse gear that will permit of proper regulation of valve cut-off under all circumstances (R. 1274-5).

O. E. WARD, Supt. M. P., C. B. & Q. (a) The effect of creeping is to admit more or less steam than is necessary into the cylinders for the maximum efficient operation, causing the use of more fuel than otherwise would be required (R. 1285).

FREDERICK KERBY, Asst. to Chief of M. P., B. & O. (a) Witness stated that creeping power reverse gears are not economical with respect to fuel and water, and because of this creeping they cause damage to property and personal injury. It also prevents the engineer from

making fast or schedule time and causes damage to the locomotive (R. 1307).

VIII. Opinions of Witnesses As to Comparative Safety of Hand Operated and Air Operated Reverse Gears.

COMPLAINANTS' WITNESSES.

Opinion.

M. J. Hunt, D. & H. Could not make a comparison; there is no danger with air reverse lever (R. 255).

LeRoy Stuckey, Penna. So far as danger is concerned, it is more dangerous to handle the lever because there is no danger of your getting hurt with the power reverse, that is with the kind I have operated (R. 264).

Matthias Ginder, Erie. Power reverse a lot safer than the hand reverse. They are not as hard to handle and there is not as much danger in getting hurt. You don't need the power to reverse them that you do with a hand reverse (R. 278).

W. B. Southard, Mich. Central. Power reverse is 100 per cent safer than the hand reverse because there is no danger of getting hurt. There is nothing there to injure you (R. 306). On cross-examination, witness admitted his opinion would be changed if he knew that men had been hurt (R. 307).

A. K. Pearce, S. A. L. Regarding safety, "the power reverse is superior in every manner because I see no possible chance for a man to get hurt" (R. 311).

J. L. Stakeman, C. & E. I. Power reverse far beyond anything he knows, because you are not afraid the

lever is going to hit you on the foot when you are running along; you have got your foot outside of the reverse or quadrant. He wouldn't say whether a footbrace would help out or not (R. 314).

J. H. AUSTIN, S. & A. Does not consider there is any danger at all with power reverse; does not see how anyone could get hurt unless the engine would turn over and stick the lever into him or something like that (R. 323).

ARTHUR R. RUDOLPH, C. & N. W. Has never been injured with a power reverse, and has never seen anyone injured, but with manual gear there is always that possible chance (R. 339). Witness basis his opinion on fact he has been injured by hand reverse gear having wrenched his back once and bruised his foot another time (R. 338).

RESPONDENTS' WITNESSES.

J. E. GELDBAUGH, B. & O. Witness stated no difference in the matter of safety between the two gears. Never found anything unsafe or dangerous about the hand operated reverse gears which he operated. In witness' opinion he never considered hand reverse unsafe (R. 428). Pumps being shut off and air going off the engine witness stated power reverse not as safe as hand reverse (R. 442).

T. W. PUGH, B. & O. There is nothing unsafe about either of them, but when putting the pump on a power reverse you can see the gear come where reverse lever sets, and with a manual you can move her ahead and back, and stop it, as you please (R. 447).

JUNIOR B. FRALEY, B. & O. From all standpoints witness stated he would prefer the hand reverse for safety (R. 461).

Roy Fraley, B. & O. As to safety, witness prefers manual reverse gear, because you have control of the engine regardless of anything else about it (R. 474).

R. Brotherton, B. & O. Witness testified he never experienced any difficulty handling hand reverse gear, while he has with power reverse. He states there are less parts to a hand gear and has seen nothing about it to hurt anyone (R. 486-7). Nothing about hand reverse that interferes with safety of operation (R. 483).

R. C. Schraffenger, B. & O. Considers the hand reverse safer because in oiling an engine he would use more caution with power reverse, and one cannot stand on the ground and oil an engine (R. 499).

Walter Prickett, B. & O. Witness stated under present condition of two gears he prefers the hand gear inasmuch as you have positive control of valves at all times, which is not the case with power reverse gears (R. 505).

L. G. Route, B. & O. Witness testified the manual reverse is safer (R. 512).

B. F. Freeland, B. & O. In his experience, witness stated the hand reverse gear is safer (R. 524).

James A. Ward, B. & O. As between the two gears, the manually operated gear would be safer to operate (R. 541).

Daniel F. Crowley, Ill. Central. In his opinion, witness stated there was no danger in handling manual reverse gears (R. 550). His experience of 41 years was all with hand reverse gears (R. 550).

Miles Crystal, Ill. Central. Witness stated he was never injured nor has he ever seen anyone else injured by manual reverse gears (R. 552).

ERNEST C. RICHTER, C. & N. W. Hand lever is the safer of the two (R. 564).

CHARLES S. THORP, C. & N. W. Believes the hand lever safer (R. 577).

H. HERRICK, C. & N. W. Since he has never had an accident with manual reverse and has with power reverse, witness believes the hand reverse is safer (R. 583).

H. PROEBSTLE, C. & N. W. Would prefer the manual gear from standpoint of safety (R. 593). In his opinion, hand lever is safer than power reverse (R. 598).

A. OLSEN, C. & N. W. Cannot see any difference between the two from a safety standpoint (R. 623).

W. B. SUMMERS, C. & N. W. Believes the hand lever is safer (R. 627).

S. RASMUSSEN, C. & N. W. Hand gear is safer because it will stay where it is put (R. 635).

HENRY E. BLOWERS, C. & N. W. As a safety appliance, witness stated he did not know as he had a choice between them (R. 637).

PIERCE J. WELSH, C. & N. W. Never found the hand gear unsafe (R. 640).

O. B. LINDQUIST, C. & N. W. Believes hand reverse safer (R. 648).

C. A. JEFFERS, C. & N. W. Hand lever is safer considering safety to all concerned (R. 660).

H. L. WILLIAMS, C. & N. W. Hand lever is safer in many ways. Will hold point of cut-off, will hold engine standing without air; keeps the gear in position when air reverse does not always do that (R. 676).

T. W. WATT, C. & N. W. The hand lever is safer (R. 682).

E. G. BATES, C. & N. W. Sees no advantage in putting on power reverse (R. 684).

C. W. BURKHALTER, C. B. & Q. Hand reverse is safer because you can see and know what it is doing at all times (R. 693).

F. W. HECK, Ill. Central. Manually operated engine would be safer (R. 696).

W. S. BEACH, Union Pacific. Stated there is no danger in connection with handling hand reverse (R. 700).

JOHN AITA, Union Pacific. Hand reverse safer (R. 703).

ELMER HOLMQUIST, C. & N. W. If both in good working condition they are safe to operate (R. 710).

H. S. RYDER, N. Y. O. & W. Considers hand reverse safer (R. 716).

ROY WILKINS, St. L. S. W. Power reverse is safe as long as you keep it in good working condition (R. 719).

W. G. KNIGHT, Mech. Supt., B. & Aroostook. As a safety appliance, absolutely no need of power reverse (R. 721).

H. E. TEWKSBURY, Travel. Engineer & Air Brake Insp., B. & Aroostook. Considers hand operated gear fully as safe, if not safer, than power operated gear (R. 730).

W. V. RYAN, N. Y. C. About 50-50; witness cannot see that one is any safer than the other (R. 750).

R. B. SLOSSON, Nor. Pacific. Hand lever much safer (R. 759).

EDWIN C. COYLE, Nor. Pacific. The hand lever is safer (R. 768).

H. HOEFT, Great Northern. Thinks hand reverse is the safer of the two (R. 779).

H. A. ROWE, Great Northern. Never experienced a defect of any kind with hand reverse, nor throwing herself back towards center (R. 785).

FRANK O'NEILL, Great Northern. From standpoint of engineer, it is a 50-50 proposition, but from cases where she reversed herself three or four times believe hand lever would have been safer (R. 790).

G. E. HERT, Pennsylvania. With regard to safety, witness believes screw reverse safest of the three (R. 807).

D. H. JENNESS, Pennsylvania. Hand bar and screw reverse are safer (R. 810).

J. C. HARRIS, T. & N. O. Should think hand reverse gear would be safer (R. 822).

E. E. LAPAGE, C. St. P. M. & O. Hand lever is safer (R. 837).

J. F. FLYNN, C. St. P. M. & O. Hand lever will stay where you put it and ready to be used at any time (R. 841).

A. E. LIEBER, N. Y. C. & St. L. About 50-50 proposition (R. 846).

EDWARD WHETSTONE, Reading. Witness considers hand bar safer (R. 857).

THOMAS HORAN, Reading. Believes manual reverse is safer (R. 861).

CHARLES E. BEECHER, Reading. In witness' opinion, the manual reverse is safer (R. 864).

H. L. Cosper, Rd. Foreman of Engines, Wabash. The hand gear is safer (R. 869).

Jesse Traylor, L. & N. In witness' opinion, the manual reverse gear is safer (R. 889).

O. G. McPhail, Fuel Supervisor, L. & N. In his judgment, witness stated manual reverse is a safe instrument with which to work (R. 898).

L. W. Pulliam, Travel. Engr., L. & N. The manual reverse is safer (R. 902).

A. E. Wood, Travel. Engr., L. & N. Manual reverse gear is safer for engineer and those who work on or near the locomotive (R. 906).

J. J. Fitzgerald, N. Y. N. H. & H. About 50-50 with respect to safety (R. 918).

James F. Jones, N. Y. N. H. & H. Hand reverse is safer (R. 924).

Howard Bobbitt, Road Foreman of Engines, Nor. Southern. Has never seen nor heard of anyone being injured by manual reverse gear (R. 939).

Walter E. Butler, Western Maryland. In emergency cases, the hand reverse is safer (R. 951).

W. H. Bailey, Union Pacific. From standpoint of safe operation of a locomotive, the hand reverse gear is very much superior to the power reverse. The hand reverse gear is much safer (R. 1105).

J. W. Burnett, Asst. Genl. Supt. M. P. & M., Union Pacific. In his opinion, witness stated "there is no hazard to the hand or the power reverse gear to the engineman operating the locomotive, but around roundhouses and engine terminals the power gear is not always reliable, and frequently becomes inoperative, and

there is a hazard to other employees, coal chute attendants, and men employed inside of the roundhouses'' (R. 1115).

B. H. Canady, A. T. & S. F. Witness testified he would rather work around a hand reversed engine, for it is safer for a shop man (R. 1150).

E. Von Bergen, Genl. Air Brake & Car Heating Engr., Ill. Central. So far as operation of the levers is concerned, the manual and power reverse levers are both safe devices. When considering the safety of others, such as those caught in valve gears when they are reversed, and accidents resulting from locomotives moving in a direction opposite to that indicated by position of power reverse lever, or when control of locomotive is lost account of loss of air pressure, the manual reverse is much safer than the power reverse gear. Accidents incident to operation of power reverse gear are generally of a far more serious nature than those incident to manual gear (R. 1183-4).

J. E. Bjorkholm, Asst. Supt. M. P., C. M. St. P. & P. Witness stated that neither gear, manual or power, could be seriously considered to the exclusion of the other (R. 1201).

E. B. Hall, Genl. Supt. M. P. & M., C. & N. W. Witness testified that the safety of operation would not be promoted in any way by putting power reverse gears on those engines now equipped with manual reverse gears. Nor can witness see that safety would be promoted from any other standpoint by putting on power reverse (R. 1222). He mentioned three classes of accidents which have been experienced with power reverse gears and not experienced with hand levers; and a fourth class which is most unlikely and practically impossible to happen with hand reverse gears (R. 1215-7).

W. J. Crabbs, Western Maryland. Witness' opinion is that "the hand bar is a more reliable device and admits of more, perhaps, in meeting an emergency which is not met by a power reverse" (R. 1243). In witness' opinion, the application of power reverse gears to those engines now equipped with hand reverse gears would not contribute anything in the way of added safety in operation (R. 1244).

G. A. Moriarty, Genl. Mech. Supt., N. Y. N. H. & H. The manually operated reverse gear does not constitute a hazard or render the locomotive dangerous or unsafe to operate (R. 1255). Witness stated that "generally I feel that the hand operated lever is a safer apparatus than the power reverse" (R. 1260).

J. E. Ingling, Erie. So far as safety is concerned, it is the opinion of the witness that they rank about fifty-fifty (R. 1265).

E. R. Gorman, Supt. M. P. & M., C. St. P. M. & O. In his opinion, witness stated safety of operation would not be promoted by substituting power reverse gears for the hand levers (R. 1278). "The introduction of power reverse gears has been responsible for a type of accident unknown prior to their application, due to locomotives moving the opposite direction to that indicated by the lever" (R. 1277-8).

O. E. Ward, Supt. M. P., C. B. & Q. Application of power reverse gears to locomotives now equipped with manual reverse gears, witness stated, would not in any way promote safety of operation (R. 1287). Of the two gears, *i. e.*, manual and power, the manual is the safer (R. 1290). Our experience has been that when we have an injury with power reverse gear it is more serious (R. 1288).

S. M. MOLTE, Southern Pacific. "In general I don't consider there is any difference" between the power reverse and the hand reverse as to safety. "Of course in the particular case of mine, if I had had hand reverse I could have prevented the accident in that specific case." (He referred to case of collision between his engine and train when power reverse failed to function, injuring three men; see exhibit 103) (R. 1320).

IX. ACCIDENTS WITH POWER REVERSE GEARS.

RESPONDENTS' WITNESSES.

(a) Injuries to enginemen in cab.

(b) Injuries to enginemen and others while working around locomotive, oiling, etc.

(c) Injuries received while inspecting or repairing power reverse gear.

(d) Failure of power reverse to operate while in use on the road.

(e) Cases occurring at roundhouses and terminals where power reverse failed to function.

(f) Other cases.

ACCIDENT.

JUNIOR B. FRALEY, age 46, years of service 21, B. & O. (a) Sept. 13, 1928, in knocking latch out of bar of Mellin gear it flew back against boiler head, wrenching witness' back and shoulder (R. 455). Was endeavoring to handle it in ordinary and customary way (R. 456). Engine standing still. Off duty 10 days (R. 455-456).

(d) Running backwards down hill on Mallet engine when the gear reversed itself knocking out a cylinder head, causing steam to emit from the cylinder and put-

ting engine in reverse motion, stopping it suddenly. This was a Barco power reverse gear. The operating lever moved by itself and reversed the engine (R. 456-457).

R. BROTHERTON, age 49, years of service 32, B. & O.

(a) Witness has had his hand bruised by power reverse lever kicking, and at times compelled to kick it down into corner with his foot in order to stop it. This was E type Alco (R. 483). Reversing Engine 641 on May 20, 1929, in forward motion power reverse started kicking, causing witness to lose control of throttle, and standing in an inclined position, put his left hand out to catch himself, catching two fingers between throttle lever latch and pin, mashing nail off one finger and mashing other finger necessitating a stitch to be put in it (R. 485).

(b) Witness related witnessing an accident to an oiler who had been oiling locomotive when valve gear moved ahead, witness jumping on engine and moving reverse lever in back motion, releasing man's hand. Oiler developed blood poisoning as result and went out of his mind for three months; laid up for a year. Power reverse lever was moved by man on the engine (R. 486).

(d) Witness testified that Engine 1072 with Alco, type E gear, on three different days power reverse mechanism was defective and required to move engine in direction in which it was standing in order to move valve and reverse the engine. It worked so hard that half the time you didn't know whether you could get it over or not; necessary to rattle, jerk and push on it (R. 492).

R. C. SCHRAFFENGER, age 32, years of service 8, B. & O.

(e) On one occasion power reverse failed to function

necessitating use of shaker bar by fireman getting under the engine frame with the bar to reverse the engine (R. 502).

WALTER PRICKETT, age 49, years of service 28, B. & O. (e) Has observed engines at terminal when air pressure was pumped and valve motion would rise up and down about four inches, and no one moving operating lever (R. 505).

JAMES A. WARD, age 54, years of service 34, B. & O. (e) Has seen engines equipped with Barco gear in roundhouse with die block moving up and down in the link, and reach rod connection to tumbling shaft arm moving without anyone operating the lever, and considers this unsafe (R. 542-543).

MILES CRYSTAL, age 39, years of service 19, Ill. Cent. (f) Witness (fireman) on May 3, 1929, preparatory to moving engine sounded whistle and bell and threw Ragonnet power reverse gear into forward position. Engineer Boggs was standing on the ground. Movement of the reverse gear caused his head to be caught and crushed between the radius rod and the main reservoir. The minimum and maximum space between radius rod and main reservoir is $4\frac{1}{2}''$ and $8\frac{1}{2}''$. Witness stated with power reverse you cannot feel any obstruction in the gears, but that with hand reverse you can (R. 550-1); also with hand reverse you can stop the movement of the gear at any time, while with Ragonnet type gear the piston will move to correspond with the movement of the valve; there is a question of time to shut off the exhaust from the air port before you move it in the opposite direction (R. 552). Witness further stated that in his opinion had this engine been hand reversed he would have felt the obstruction (R. 551).

C. P. McCaskill, age 56, years of service 32, Ill. Cent. (d) Engine was popping to such an extent witness could not distinguish exhaust from lever, and reversing engine too quickly it did not catch, running into another locomotive, breaking both draw bars off of both engines. Date, 1917. When pulling reverse lever over, power gear failed to function (R. 553).

Charles S. Thorp, age 69, years of service 51, C. & N. W. (e) Witness testified seeing power reverse (Alco) engine backing out of roundhouse without anyone being on it. Jumping into the cab he tried to stop it, but could not because the air pump had not been started, and she went into turntable pit, the hind trucks going into the pit. If this had been a hand reversed engine witness stated he would have been able to reverse it and start it in the opposite direction, thus preventing accident (R. 576).

Frank Ellis, years of service 35, St. L. S. F. (f) Witness testified of knowing cases where power reverse gear was badly damaged account of lack of lubrication where engineer knew nothing about it until arriving at terminal. With manual reverse gear you can pick up lack of lubrication quickly and correct it before substantial harm has been done (R. 607).

J. L. Ryan, years of service 20, St. L. S. F. (d) In 1929, Engine 1508, power reverse inoperative, because reverse lever latch bridle rod broke causing delay of 1 hour and 10 minutes (R. 618).

A. Olsen, age 51, years of service 28, C. & N. W. (b) May 30, 1931 (Ragonnet gear) in taking feed valve down on Engine 2362 to oil it witness drew all the air pressure

out of main reservoir and after oiling it and putting it in place he turned the air into main reservoir and as it was pumping up the power reverse crosshead "shimmied" back and forth, catching witness' glove and knocking him off the rod where he had to stand to reach the cock. Would not have occurred with hand reversed engine (R. 621).

(d) May 26, 1931, the connection of lever to reach rod broke on Barco gear causing engine to reverse itself at 40 miles per hour; fire shot out of the fire box door, the driving wheels skidded causing flat spots on wheels and the bull-ring was broken on the right side (R. 620-621).

S. Rasmussen, age 53, years of service 31. C. & N. W. (b) On Dec. 2, 1926, Engine 1764, witness, while oiling engine had his right arm caught between radius rod and guide bar. Fireman on opposite side of engine reversed the engine without any warning. Witness did not know he was in cab. Lost about six days, but could not remember the amount of settlement (R. 633-634). Fireman reversed engine and released his arm. Did not know why fireman moved lever unless it was in his way and he was cleaning out the seat box. Witness indicated if this had been a hand reverse gear moved in the usual way he would have had sufficient warning to get his hand out of the way. If the fireman had moved the lever more quickly and forceably than usual so witness would not have the usual warning he states he might have been likewise caught with a hand gear; but he brought out the greater chance to escape such an injury with the hand gear and the lack of any warning with the power gear, quite clearly (R. 634).

HENRY E. BLOWERS, age 63, years of service 49, C. & N. W. (c) On May 15, 1929, Fairmont, Minn., witness had four toes severed when foot was caught between eccentric crank and main rod. Engine 1754 (Alco) was getting lame, and reverse gear was creeping. In order to tighten the nuts on power reverse gland to stop this, witness stepped upon main rod of engine with one foot as necessary to get at the power reverse mechanism and asked fireman to throw lever ahead a little so he could get his wrench on the nut. When the reverse lever was moved this caused the engine to move catching his foot. Witness laid up five months and fifteen days. If engine had been equipped with hand lever this accident would not have happened (R. 637).

A. SHOCKLEY, age 63, years of service 39, C. B. & Q. (e) In 1916, witness working as hostler attempted to move Engine 5263 at roundhouse, which had Ragonett power reverse gear. After a thorough search to ascertain if anyone underneath or around the engine, witness pulled reverse lever back in the corner to back out of the house. Giving her a little steam she failed to move, and then suddenly jumped and went ahead (instead of backward as intended), pinning boiler maker foreman named Bradley against the wall. Witness was then unable to reverse engine and had to be pulled back by another engine. Bradley was killed. Never had any such experience with a hand reversed engine (R. 641-2).

C. A. JEFFERS, age 53, years of service 35½, C. & N. W. (e) July 15, 1930, Engine 2313 standing in Clinton roundhouse went into roundhouse wall, there being no one in the cab. When air pressure applied gear began chattering or shimmying. Had between 40 and 60 pounds of air. Investigation disclosed power reverse gear crosshead would move some when pressure went

down. Power reverse lever was on center (R. 651-652). June 15, 1930, Engine 2306 went into wall at Clinton roundhouse with no one in cab. House pressure had been applied and it was going down, moving valve gear in forward motion enough so that she got steam in cylinders and went into roundhouse wall. Operating lever as near center as you can place it. Had around 50 or 60 pounds of air (R. 652). January 26, 1929, Engine 2136 (Alco gear) at Council Bluffs, Ia., climbed over blocks and went into turntable pit. Lever on center. No one in cab. Air pressure going down. Crosshead would move in the guides. Opinion of witness engine got enough water from boiler to make steam (R. 653). Witness stated two other cases occurring at Council Bluffs where power reversed engines moved ahead with no one in cab (Engine 2179, Ragonett gear), Sept. 10, 1928, striking another engine (R. 653). In none of these instances would it have been possible for these engines to move if equipped with hand reverse gears latched at center (R. 654).

S. J. BUCKNER, age 54, years of service 27, Ill. Central. (b) Standing on combination lever, holding to radius rod, to oil top end of link, machinist reversed engine to get lever out of way, throwing witness 4 or 5 feet against another engine (R. 670).

(e) Witness, observing hand reversed engine leaving roundhouse of its own volition, backing up, jumped on engine, threw brake valve in emergency, but there was no air; then threw reverse lever in forward position and gave her enough steam to stop it. Took her back 20 feet to allow first-class passenger train to pass and thus averted a serious accident (R. 669-670). Witness stated if this engine had been equipped with power reverse it would not have been possible to have stopped

it because there was no air pressure on the engine (R. 670). Witness has observed valve gear or radius rod and piston of power reverse engines going up inside; has seen it make 6, 8 or 10 strokes up and down full length of the link. "Anybody working on it, anybody oiling it, would be liable to be hit" (R. 670).

(f) Engine working where cottonseed oil was being crushed witness could not hear power gear reversing, and when failing to reverse, he was obliged to sight side of cab and building to ascertain direction in which it was moving (R. 670).

A. L. Sawyers, age 30, Ill. Central. (b) February 29, 1928, Ashkum, Ill., Engine 2435; engine equipped with Precision power reverse; witness (fireman) told to reverse engine when same was stopped. Developing hot box engineer got down and attempted to put a block under spring saddle. When witness reversed engine engineer had his arm over guide under radius rod. Radius rod came down a little above his writ crushing it very badly. Witness testified that with hand reverse gears you can detect an obstruction in the gear by a different "feel" in moving the lever; but with power reverse there is no way of telling or detecting an obstruction (R. 672-673). In injuring this engineer, he stopped turning the reverse gear wheel as soon as he heard the man cry out (R. 672).

H. L. Williams, age 48, years of service 24, C. & N. W. (d) Witness testified from two work reports (Exhibit 25) engine with latest type Alco gear broke down; broke left valve crank reverse yoke, knocked out left valve-head and broke eccentric valve and engine had to be taken out of train. Taking train in from Lamont to Clinton (prior to this accident) reverse gear would not hold one side of engine without going almost to

corner. Investigation disclosed nothing wrong with gear when they went all through it after the accident; it tested alright and was well lubricated (R. 676). Witness detailed several other accidents where power reverse permitted engines to go into backward motion while moving forward (R. 674).

T. W. WATT, years of service 20, C. & N. W. (e) Witness has observed the reach rod, valve gear and valve piston, especially with the Alco, moving while engine standing still without any movement of operating lever of power reverse (R. 681). In May, 1931, Engine 1658, the air was escaping and witness could not move the power reverse lever. Discovered lug had broken off into the casting and remaining air in main drum was escaping. Stopped engine with brake, but stated if he had not been able to stop it with the remaining air pressure engine would have gone throug employees' wash room as power reverse was inoperative (R. 681-682). Witness testified to an occasion in May, 1931, where two engines moved of their own volition. One had no air; on the other, someone had closed pump instead of steam lubricator, result being the air leaked off of engine (R. 682). Witness stated that in either case if engine had been equipped with hand reverse lever he could have controlled it (R. 682).

E. G. BATES, age 64, years of service 44, C. & N. W. (a) When witness attempted to move lever of power reverse it failed to respond and then came back suddenly with a bang, striking witness (R. 684).

(d) Due to marked notch or nick broken out of quadrant, power reverse gear failed to maintain proper cut-off, result being the use of 2½ tons more coal than usual on this 61¼-mile trip (R. 684).

C. W. BURKHALTER, age 57, years of service 35, C. B. & Q. (a) In the fall of 1930, at Mendota, Ill., Ragonett gear worked very hard, being new and stiff, and witness' hand slipped down behind latch and sprained his thumb, knocking it out of place. Off duty 2 days (R. 691). Could not have happened with hand lever (R. 693).

(b) Witness observed, about 1913, at Mendota, Ill., machinist getting his arm caught in the lifting arm, the reversing gear going down and catching it. Arm nearly broken. There was no one in the engine cab at the time (R. 692).

(c) July 10, 1917, Altoona, Ill., Engine 5246 creeping very badly. Stopping engine to oil and ascertain trouble, and not finding anything wrong, witness, in returning to cab, found reverse gear in forward motion. Shut off air and poured black oil and water to soften gasket in main piston. Standing on frame to turn on air, lifting arm on back of lifting link arm caught witness' foot, crushing it and pulling second toe out by root. Off duty 87 days. Company paid him $500 and $2 a day for the 87 days; also doctor's bill (R. 691). Wouldn't have happened with hand lever (R. 693).

(d) Witness testified to three cases (in 1912, 1927 and 1928) where mechanism of power reverse broke necessitating delays. Wouldn't have happened with hand lever (R. 692-3).

(e) Witness related an incident where his engine collided with and damaged the tank of another engine because both power reverse and air had become frozen and inoperative while standing at terminal. He could have prevented it with a hand lever (R. 691-692).

F. W. HECK, age 44, years of service 26, Ill. Central. (b) This witness corroborated testimony of witness Sawyers with respect to accident to Engineer James Pe-

terman on Engine 2435 occurring February 29, 1928, when Peterman's arm was squeezed due to link block starting down (R. 695). In witness' opinion, this accident would not have happened if he had had a manually operated engine (R. 696).

JOHN AITA, age 47, years of service 29, Un. Pacific. (d) September 23, 1930, Fremont, Nebr., steam pipe to air pump broke off. Air pressure getting low, witness cut in steam to power reverse gear in order to have something to control it in event he needed it. Target on switch being red, witness couldn't budge lever although he continually tried to do so and ran through switch into train ahead, overturning two cars and tearing full length side of another. Damage: $3,000. Witness stated if he had had a manual reverse gear he could have stopped the engine on this occasion (R. 702-703).

ALANSON BEACH, age 30, years of service 9, Un. Pacific. (e) During 1928, power reverse gear failed to move when witness opened throttle. Putting reverse lever on center engine went forward, tearing down roundhouse wall, a counter and tool room. Damage about $500 (R. 705-706). Witness stated accident could not have happened with hand reversed engine (R. 706).

ELMER HOLMQUIST, M. Mechanic, age 53, years of service 33, C. & N. W. (e) Witness testified that power reverse gears have been known to move without action on the part of anyone, which is not true of hand reverse gears (R. 710).

JAMES F. WELLS, age 40, years of service 8, C. R. I. & P. (b) On August 22, 1930, Engine 2136, Booneville Roundhouse, Machinist Garrett was killed by power reverse gear which he knew witness would operate after waiting for sufficient air to reverse the engine. Deceased was on left side of engine. After moving engine far

enough back witness moved reverse lever to center and then saw decedent as though looking into some part of machinery. He went down on ground and then learned that deceased's neck was caught between valve stem guide and radius rod. Witness then lifted deceased's body off ground and supported him until another employee moved the reverse lever and witness then saw the radius bar raise and it had to raise to get deceased's head out (R. 712). No blame whatever was attached to the witness for this accident.

Ira C. Wallace, age 60, years of service 39, N. Y. O. & W. (e) October 13, 1916, witness was in cab while Engine 356 (Ragonett gear) moved forward about 150 feet into shop of its own volition, killing one man and seriously injuring two. Leaky throttle caused engine to move. Air pressure not yet pumped up so power reverse and brakes would not operate and there was no way to stop the locomotive (R. 715-6; Ex. 36, R. 1493-5). If engine had been equipped with hand reverse witness stated he could have stopped the engine (R. 715-716).

Roy Wilkins, age 49, years of service 30, St. L. S. W. (b) While oiling Engine 765 (Ragonett gear) on February 10, 1922, at Illmo, Mo., witness putting hand between reverse yoke and valve frame to pull himself up, air reverse went from center to forward corner, releasing witness by going into back corner, cutting off three fingers of left hand. Off duty six months, company paying him $3,000. The reverse lever was on center at the

who was sitting on the fireman's seat-box (opposite side of cab from reverse lever). Would not have happened with hand gear (R. 718-719).

G. H. Truman, age 73, years of service 58, Nor. Pac. (b) While oiling power reversed Engine 2227 on May 30, 1921, witness had his right arm caught by radius rod,

which broke his arm, necessitating his being off duty for two years, the company paying him $8,750 damages and hospital expenses (R. 735).

J. C. MURPHY, age 66, years of service 44, Nor. Pac. (b) This witness corroborated the testimony of the preceding witness, Truman, with respect to the accident, and stated he accidentally moved the lever of this Mellin type power reverse by brushing against it. He stated if he had accidentally hit against a hand reverse under these circumstances this injury would not have occurred (R. 737).

W. V. RYAN, age 38, years of service 15, N. Y. C. (a) On April 8, 1929, Engine 5214 would not start and necessary to reverse her. After several attempts power reverse (Precision) failed to respond. After turning it seven or eight times, without any warning wheel suddenly spun and gear went to extreme back motion, the handle striking witness on wrist, breaking two bones. Off duty 68 days, the company paying him $524 in addition to doctor and hospital bills (R. 749).

R. B. SLOSSON, age 59, years of service 32, Nor. Pac. (a) During June, 1929, Engine 2608 while traveling at 60 miles an hour latch jumped out and wheel of Precision power reverse gear was wabbling, dog going out and engine went into corner, the rim breaking off the spokes of the power reverse wheel, striking witness' knee. Lost no time off, but required to take treatment every other day for two years (R. 757).

EDWIN C. COYLE, age 47, years of service 27, Nor. Pac. (a) January, 1927, Saltese, Montana, operating lever on McCarroll power reverse gear broke inside of air chamber, necessitating witness reversing engine by hand. Working pretty hard fireman assisted him and his hand struck cut-out cock and motor of power reverse started

to reverse, the crank striking him (fireman) on back of hand, breaking two bones (R. 768).

(f) Either in 1914 or 1915, while helping on rear end of train the lever or power reverse gear jumped from forward to backward motion, throwing left thumb out of joint (R. 768).

JOSEPH COLACHE, Penna. (c) May 20, 1930, Alco power reverse started jumping back and forth and witness held reverse lever in center to avoid cylinder head being knocked off, blistering his hand (R. 803).

O. E. HENRY, age 57, years of service 30, Penna. (b) In March, 1925, Conway Yard, Engine 4689-I-1, Alco power reverse, failed to move far enough ahead, and while endeavoring to locate the trouble witness was struck in the head by radius rod, fracturing his skull, being off duty 17 months, the company paying him $10,000. Reverse lever came out of quadrant and moved of its own volition. A broken trunyon pin caused it (R. 804).

B. B. COOKSEY, age 48, years of service 24, Southern Pacific. (a) Witness on May 2, 1929, Robsart, N. M. (Engine 4386), had a runaway passenger engine on descending grade account of eccentric rod breaking and breaking off final discharge valve of the air compressor, causing air to escape, leaving witness without air to operate brakes or power reverse gear. Engine running light. Attempted to operate reverse gear to avoid head-on collision, but gear was inoperative; could not get steam into reverse gear so as to reverse and stop the engine, result being witness and fireman jumped, and next he knew he and fireman were being taken to hospital (R. 816, Exhibits 40 & 90). Witness said he had reason to believe he could have controlled the speed of the engine and have avoided the collision if he had had

a manual reverse geared engine (R. 817). Injured shoulder, right kidney and broke big toe. Off duty 4 months and 7 days. Settlement $1,200. Fireman received two scalp wounds and injured his wrist (R. 818). The purpose of the witness in endeavoring to reverse the engine was to use the steam in the cylinders, on the side not disabled, for braking purposes in an endeavor to stop the engine (R. 816). The Form T report shows the broken eccentric rod had an old 15 per cent flaw in it (a hidden defect), and that the following damage occurred: Railroad property damage and expense, $17,500; 68 fat lambs killed, 11 injured, 5 missing; engineer on other train, strains and bruises (Ex. 90). Cooksey's engine ran head-on at high speed into a freight train—a photograph of the wreck is in evidence (Ex. 40).

A. W. LIEBER, age 46, years of service 19, N. Y. C. & St. L. (b) About 1926, while oiling main wedge on Yard Engine, radius rod came down on witness' hand, as he was reaching over the top valve gear frame, breaking two bones in one hand and also his arm. Off duty 3 months, company paying him $350 and doctor and hospital bills. Witness could not see engineer and only has his word that he didn't move the lever (R. 846).

THOMAS HORAN, age 47, years of service 25, Reading. (e) Failure of power reverse caused engine to go into turntable; the engineer, being 20 or 30 feet from turntable gave engine steam to move up a couple of feet, forgetting he had no air; he tried reverse gear and it was inoperative, he being unable to control the engine, hurriedly got off (R. 861).

W. G. DICKHAUT, age 49, years of service 32, N. Y. C. (a) April 13, 1928 (Franklin Precision power reverse), engine failed to respond to steam; wheel turned hard.

When wheel came to go over the center it sprained witness' shoulder. Off duty 3 weeks, company paying him $100 and doctor's bill (R. 886).

JESSE TRAYLOR, age 53, years of service 32, L. & N. (e) Witness present when engine went through roundhouse wall when reverse piston moved in cylinder of air reverse; the reverse lever was in back-up position, but there being only about 30 pounds of air pressure, the valve gear was in forward motion (R. 890).

O. G. MCPHAIL, Fuel Supvr., age 57, L. & N. (b) Witness present when engineer of another locomotive had his arm broken in two places when radius bar of power reversed engine moved while he was oiling; had his arm between radius bar and guide of the valve crosshead (R. 899).

A. E. WOOD, Travel. Engr., age 51, years of service 30, L. & N. (e) Witness present on two occasions when power reversed engines ran into turntable pits, having only about 30 pounds air pressure which was insufficient to operate either reverse gear or brakes. If equipped with hand reverse gears it would have been possible to stop these engines before running into pits (R. 907).

EDWARD LANDERS, age 54, years of service 33, N. Y. N. H. & H. (b) January 20, 1928, witness received severe burn on wrist while thawing out frozen power reverse gear (Alco). Off duty 14 days (R. 927).

J. E. BAKER, age 49, years of service 28, Western Md. (a) In April, 1922, power reverse Engine 925 moved of its own accord, running into turntable pit, knocking the house off the turntable; turntable operator would have been killed had he not moved quickly out of his house. If equipped with hand reverse could have stopped it (R. 943).

H. E. CARRYER, age 59, Western Md. (e) June 10, 1926, power reversed Engine 801 with 40 or 45 pounds of steam moved a little bit when witness opened stoker valve. When he opened throttle valve to air pump—there being no air—engine ran over chucks into turntable pit and he was unable to stop it (R. 944). Damage: $1,200 (R. 945). Witness stated if this engine had been equipped with a hand reverse he would have been able to stop it (R. 944).

E. A. CHASHMAN, age 46, years of service 30, Western Md. (d) During 1927, Barco power reverse on either Engine 1111 or 1114 failed to move because worm in gear was galded. Witness obliged to take it apart, file and clean it out, and fill it with grease, before it would function. Delayed from two to two and one-half hours (R. 945-946).

WALTER E. BUTLER, age 47, years of service 31, Western Md. (e) Engine stalled due to inoperation of power reverse. Delayed one hour (R. 950).

J. H. DALZELL, age 45, years of service 26, Union Pacific. (d) February 2, 1917 (Ragonett gear), witness was in helper service, and on return trip to San Bernardino he heard a noise on right side of engine and saw air pressure going back rapidly. He set the air and reversed the engine. Walking along engine at 3 or 4 miles an hour, she suddenly again reversed herself. He got back on and tightened up tender brake and fireman opened valve at the fountain; intermediate valve pipe was cold. Moving operating lever to power reverse witness got no response. Engine was increasing speed rapidly on steep grade and was rolling to such an extent witness expected her to turn over every second, and he was unable to stop her. For protection, witness and fireman crawled back over tank. Having run past two red block signals and just hitting a curve engine started

to turn over and witness did not know anything more as he was knocked out for two or three minutes. One section of a passenger train was running ahead of this light engine and that is what made the two red block signals as the light engine drew close to it. A second section of the passenger train was following the light engine. As soon as Engineer Dalzell recovered consciousness he ran back up the grade and flagged this second section which was even then descending this steep mountain grade to where the track was torn up by his own engine's derailment. No. 21 picked up witness as he was ready to drop, and put him in baggage car. Witness' right elbow was broken; he received contusions on the back of his neck, and cuts over top of head. Fireman was instantly killed. It was witness' opinion that a pipe had broken causing him to lose air. He was out of service little over 5 months, being confined to hospital (R. 1088-1090). Witness stated that had this engine been equipped with hand reverse he could have stopped it (R. 1091). (This was L. A. & S. L. Engine No. 3703) (R. 1091). Received about $900, and hospital bill (R. 1092). (Fireman killed named Davis, survivers receiving $3,500; property damage $2,800) (R. 1109).

George E. Stearns, age 54, years of service 28, Union Pacific. (b) After oiling around Engine 2866 (Franklin Ragonnet reverse gear) at North Platte, Nebr., in the evening (7:40 p. m.) of October 24, 1923, at which time the maintenance men and helpers were also working on this engine, witness began to work power reverse lever from center to back motion when a man named Newman called to him that a man was caught in the gear. Witness released the lever and the man fell off backward. The rocker arm shaft caught him under the jaw, pushing his head against the reservoir, mashing his head and

killing him instantly (Harley C. Bunnell) (R. 1096-1097). In his opinion, witness stated this accident would have been avoided if this engine had been equipped with manual reverse gear, as he would have thrown this in a backward motion and would have felt the obstruction to the gear and stopped to look around and see what caused the obstruction (R. 1097-1100). (Widow of Bunnell received $6,000 from Company) (R. 1109).

W. H. Bailey, age 58, years of service 27, Union Pacific. (f) While operating a Precision screw type gear on Engine 7006 November, 1927, on a passing track and curve, witness could not see ahead, and collided with a caboose. First signal he received was possibly half an engine length. Was running about 8 miles an hour. In attempting to avoid the collision, witness closed the throttle and got the straight air in one hand and tried to reverse her with the other. He was unable to reverse the engine prior to the time it struck the caboose. If engine had been equipped with hand reverse gear witness stated he would have been able to reverse the engine before the collision (R. 1103).

(d) About 4:15 P. M. January 16, 1929, Alco gear, Engine 5089 (Young valve motion) witness had cut out at Wahsatch and was returning to Ogden light. In going down hill about 11 miles per hour he heard machinery break on left side. Getting engine down to 12 or 15 miles he discovered air was going from both the main reservoir pressure and train line, and trying to reverse the engine the reverse gear would not respond. Could not get the steam cut in because in trying to do so quickly he had twisted off the cotter key in the valve. Could not get into fountain because of steam and hot water. Repeatedly tried the reverse gear but it would not operate. Nothing left for him to do; witness

jumped, engine then going about 80 miles an hour. Having rolled a few times and temporarily blanked, and realizing something had happened, heard the engine hit some steel gondola cars, splitting one in two. Block signal was against him as the switch crew had just crossed main line and had switch improperly set. Developed afterwards that it was the main rod on the left side that had broken; knocking off No. 1 air pump, and breaking 2″ discharge pipe from the pump, losing air from the main reservoir. If engine had been equipped with hand reverse witness stated he could have stopped it on the descending grade (R. 1103-1104). Property damages $2,885 (R. 1115).

J. W. Burnett, Asst. G. S. M. P. & M., age 41, years of service 25, Union Pacific. (b) Witness in speaking about the accident to Engine 2866, Franklin Ragonett, Pacific type, when Harley C. Bunnell was killed, testified that in his opinion "the accident would not have occurred had the engine been equipped with hand reverse gear", because from his experience as an engineer, fireman and mechanic, he has frequently felt obstructions in the valve motion which would indicate that the valve gear was not free (R. 1110-1111).

(e) Witness related accident occurring at Council Bluffs, Ia., September 17, 1928, when Yard Engine 1926 was placed in engine house for repairs. Taking engine out of house hostler placed lever in cab in reverse and opened throttle, but power reverse gear lever being disconnected gear remained in forward position and engine started ahead, striking partition, resulting in a property damage of $300. Had engine been equipped with hand gear action of lever would indicate it was disconnected (R. 1112-1113).

Scott W. Snyder, age 46, A. T. & S. F. (b) October 16, 1916, while Engine 3503 (Ragonnet, Pacific type) was standing awaiting signal, engineer Gus Carlson was oiling guide cups, and when signal was received witness (fireman) rang the bell and reversed the engine, catching the engineer between bell crank and valve frame and carrying him along on frame unconscious. Engineer's chest crushed, ribs broken and lungs affected; off duty 9 months, and received compensation of $7,000 (R. 1136-1137; Ex. 76, R. 1553).

B. F. Moore, age 37, years of service 13, A. T. & S. F. (d) December 4, 1926, Engine 3305, freight train (Ragonnet power reverse), Dugger, Texas, witness caught between tumbling shaft arm, air pipes and running board, crushing muscles between arm and shoulder, necessitating being off duty three weeks. Power reverse gear failed to function, and as witness closed pet cocks and cut the air back in, the engine reversed itself, causing the injury. In his opinion, witness stated this accident could not have happened with an engine equipped with a hand reverse (R. 1138-1139).

C. W. Law, age 61, years of service 32, A. T. & S. F. (c) On July 9, 1927, power reverse gear Engine 3459; witness was unable to reverse it due to a galded link block. A number of subordinate officials were attempting to get link block loose. Witness was receiving instructions from Road Foreman Jones. Road Foreman Gilbert was on other side of engine, which fact was not known by witness. Next thing witness saw, several men were assisting Mr. Gilbert across the tracks to a water hydrant, who was bleeding freely about the face, and his clothes covered with blood. This was first indication to witness that some one had been injured (R. 1139-1140).

William Heirgood, age 67, years of service 34, A. T. & S. F. (c) Witness testified along the same line as

the previous witness, Law, respecting injury to Asst. Road Foreman Gilbert. This witness saw Mr. Gilbert fall backwards off the oil ladder. He next saw Mr. Gilbert lying on the ground. Witness did not see what happened to him. Injured party was taken to the hospital, where he remained for more than 30 days (R. 1140-1141).

LEONARD A. PEARSON, age 32, A. T. & S. F. (c) Witness substantiated the testimony of witness Law, he having been in the cab with Law when the latter was holding the reverse lever latch open and saw it drop to forward motion about 5 or 6 notches (R. 1141).

GEORGE E. KING, age 70, years of service 41, A. T. & S. F. (b) On Engine 3517 (Ragonnet power reverse), July 28, 1916, engineer pulled reverse lever back; then got down on ground and was climbing up the ladder provided to oil valve gear; air was being pumped up and the gear "let go" cutting hand and fracturing little finger. Off duty 3 months; compensation received $100 (R. 1142).

B. H. CANADY, years of service 21, A. T. & S. F. (b) On February 16, 1919 at Winslow, witness and an apprentice boy named Mespelt were squaring the valves on Engine 3530 (Ragonnet power reverse), a chronic offender. A Japanese boy named Nomato was filling the grease cups. Witness advised Japanese that he did not want him around until the job had been completed. The Jap then left for the roundhouse. Witness then climbed into cab and apprentice boy released the set screw and told witness to put her ahead. When gear was two-thirds of the way ahead it stopped. Witness got down to see what was blocking the frame and saw the Japanese boy lying over in the valve motion, the gear still against him. Putting lever in back motion, witness re-

leased him; he was bleeding profusely. He had been lying down filling the cup and was caught by the reversing yoke. He was caught back of his arms and through the chest. He died the next day in Los Angeles Hospital (R. 1147-1148). Witness stated that if he had had a hand reverse gear he doesn't think he would have hurt him (R. 1149).

(b) On another occasion when witness was freight gang foreman the valve man was under the radius bar looking up in the inside of his valve crosshead and the reverse gear jumped but didn't go far enough to seriously injure him. It caught his "wish bone" across an oil cup. This happened on an old time Ragonnet and no one was in the cab. As a matter of safety would rather work around a hand-reversed engine (R. 1150).

C. A. WALDRIP, age 62 years of service 19, A. T. & S. F. (e) On February 3, 1922, at Chanute (Kansas) roundhouse, witness had just pumped air on power reverse gear Engine 3116, and found a pipe broken off the power reverse gear from the main reservoir to the power reverse. After repairing the pipe on the power reverse witness reached up to valve on main reservoir above the rocker arm and turned air on; and as he turned the air on to the power reverse, it flew ahead in forward motion, striking him across the right arm, and breaking it. Air had been cut off and when witness turned it on the gear moved. Witness off duty and in hospital three months, receiving $250 and hospital expenses (R. 1154-5).

A. R. RECTOR, age 33, years of service 13, G. C. & S. F. (b) While witness and his helper, W. P. Attaway, were tightening guide bolts at back end of left guide on power reversed gear Engine 3147 (Ragonnet) at Temple, Texas,

and applying cotter keys, the valve gear gave a quick lunge forward, catching and mashing his helper's right hand between reversing yoke, reach rod and valve gear frame. He did not see anyone in the cab (R. 1155-1156). In witness' opinion, this accident would not have occurred with a hand reversed engine (R. 1156).

RICHARD BROWN, A. T. & S. F. (b) Witness on February 6, 1925, was employed as a laborer. On that date he was filling grease cups on a power reversed engine when the fireman reversed the engine, catching his arm and breaking the bones. Off duty 7 weeks, receiving $240 (R. 1158).

WILLIS SMITH, years of service 5, A. T. & S. F. (b) Witness Smith corroborated the testimony of the previous witness, Brown, he being the fireman who moved the power reverse lever on this engine (Ragonnet) which broke Brown's arm (R. 1158).

JAMES KIELY, age 65, years of service 53, A. T. & S. F. (b) On November 25, 1921, at Winslow, Arizona, witness Kiely was present was a hostler named Abbott was killed by power reverse gear on Walscheart valve gear Engine 3240. Witness did not see the accident, but his official investigation developed a number of men had been working around the locomotive, lubricating, looking after sand pipes, etc., when the hostler started to move the engine. Abbott was making some adjustment on a flange or lubricator when the lever was moved, catching him between the valve rod and the top guide. Abbott died that night at the Los Angeles Hospital (R. 1159-1160).

A. CRASE, A. T. & S. F. (a) On July 20, 1920, witness on Engine 3533, after coupling cars, got down on left side to fill high pressure guide cups, and putting his foot on bottom rung of ladder and reaching up to get hold of

it, something on the valve motion came over and caught his hand, fastening it there. He hollered to some one to reverse the engine, and pull the lever back, which was done. The hand was cut clean across, hanging a little bit on the back. Blood poison set in and witness remained in hospital 4½ months. So much dead bone in middle finger it was amputated. Witness now unable to work on engine. Off duty 2 years and 4 months. Now employed as stationary engineer in power plant. Compensation received at rate of $300, totaling approximately $8,700. Hospital expenses borne by relief association to which witness was a member (R. 1160-1161). Pacific type engine; 190,000 pounds power reverse gear (R. 1161). Witness indicated to cross-examiner he did not think he would have been caught if engine had had hand lever (R. 1161).

C. M. Wisham, A. T. & S. F. (b) Witness corroborates testimony of witness Crase, and testified he moved the reverse lever in back motion to get engine uncoupled from train thinking engineer had gone to lunch or to have his watch registered (R. 1162). With hand reversed engine witness stated you could not get it over so quickly and may not have gone clear to corner because there would be an obstruction, but there is not much opportunity to feel obstruction with the pressure behind power reverse gear. Injury might not have been so severe with hand gear; hand was pushed against frame (R. 1162).

Thomas E. Gallagher, age 63, years of service 39, A. T. & S. F. (b) While fireman was repairing a hot pin witness was oiling the engine. When water tank was full witness expected the fireman to jump up on the gangway. Seeing lever in back motion he put it ahead, and in doing so he heard a yell from the fireman and saw him lying on the ground about six or eight feet out from

the engine. Fireman said "you caught me when you threw her over". He received a number of bad bruises on each side of his chest. Fireman was off duty 10 days. This happened on power reverse gear (Ragonnet) Engine 3524, at Peach Springs, Arizona, on May 5, 1915 (R. 1163). Witness stated if this had been a hand reverse gear, in his opinion he did not think it would have caught him, as he would not have gotten it over fast enough to catch him (R. 1164).

L. W. ARNOLD, age 36, years of service 13, N. C. & St. L. (c) Witness while attempting to locate air leak on Engine 625 (Ragonnet) at Bruceton, Tenn., on April 11, 1928 put his foot on the guide and reached up over the frame when he was suddenly struck by the radius bar against the main air drum knocking breath out of him and when he came to the engine was backing down the tracks; a negro porter with a flashlight chanced to see him and signalled engineer to stop whereupon he was released. Torn ligaments and muscles of the back and side, being off duty 12 days, receiving about $74 in compensation, as well as doctor and hospital bills (R. 1165-6; Ex. 87, R. 1560).

W. H. CHERRY, age 56, years of service 31, N. C. & St. L. (b) On December 24, 1924, at Bruceton, Tenn., witness had his arm crushed so badly between the radius bar and the link frame on Engine 504 that it was necessary to amputate it. While oiling the driving box wedges witness placed his hand over the radius bar and fireman reversed the engine. This was a Ragonnet power reverse engine, Walscheart valve. In hospital 21 days and then placed on a pension for five years. Now station master at Atlanta, Ga. Received $3,500 and an artificial arm. If manually reversed the link motion would not have moved as quickly or with the crash that it did (R. 1166-7).

W. S. HAILEY, age 50, years of service 29, N. C. & St. L. (c) Engine 605, power reverse, (Ragonnet) on May 13, 1930, at Nashville, Tenn., had broken the piston rod of the reverse cylinder. Witness got shaker bar and as he was pressing up on the radius bar the piston shot out of the cylinder and hit what he was holding, tearing ligaments loose in his back. Off duty about 30 days, receiving about $200 and doctor and hospital bills (R. 1168). The accident would not have happened with a hand reverse gear (R. 1168).

M. A. BLACK, age 35, years of service 13, Maine Central. (c) On April 7, 1918, at Deering Junction, the engineer (Brawn) on Engine 618 (Ragonnet) had his arm broken by power reverse gear. He was standing on the running board after oiling the power reverse and told the witness to go ahead, which he did by throwing the reverse lever over, catching and breaking the engineer's arm; witness felt no obstruction (R. 1169).

E. VON BERGEN, Gen. Air Brake Engr., years of service 30, Illinois Central. (f) Witness stated that he was familiar with the circumstances surrounding the death of engineer D. W. Boggs, who was killed by power reverse gear at Decatur, Ill., on May 3, 1929, testified to by fireman Miles Crystal. In his opinion, witness said had the engine been equipped with manual reverse and engineer Boggs had failed to extricate himself in time to avoid radius bar catching his head, Crystal would have felt the obstruction, and manual reverse exerting much less force than air, engineer Boggs would very likely have escaped with bruises instead of being killed (R. 1181-2).

JOHN J. HUGHES, age 42, C. R. R. N. J. (c) On Oct. 20, 1927, witness then working as an air brake machinist

was renewing the packing leathers in the Alco power reverse gear on Engine 904. Shutting off the air, and while removing the lock nut off the forward head of the reverse gear cylinder the piston head and everything came out with great force and drove his hand against the cylinder cock rigging, partly cutting off the first finger of his left hand, lacerating the others, and breaking one bone in his wrist. Off duty eight weeks, receiving $150 and doctor's bill (R. 1203).

G. B. Hayes, age 64, A. C. L. (e) Witness on Oct. 5, 1929 while working as a hostler at Columbia, S. C., was putting power reverse Eng. 444 on storage track. When engine was down to about 40 pounds of air he pulled the operating lever back and thought he had reversed the gear. Giving her a little steam she started ahead instead of backward as intended, and witness was unable to stop her, finally stopping itself at the bottom of a 10 foot fill (R. 1207). Witness stated this accident would not have happened with a hand reversed engine because he would have been able to pull the link over with reverse bar, and could then have given it steam to act as a brake (R. 1207).

Edgar Evans, age 43, years of service 29, D. L. & W. (c) On Dec. 1, 1929, witness was working on the cylinder valves of Alco power reversed Eng. 1612 at Scranton, Pa. Before reversing the lever, witness called to "look out for reverse lever on No. 1612". After throwing the lever down to the front end of the engine witness got down off locomotive and met Engineer Reed who told him his two middle fingers were caught when the witness reversed the lever. Engineer off duty about 3 months. On cross-examination witness stated if engine had been equipped with hand reverse gear he did not think Reed's fingers would have been so badly mashed (R. 1209-10).

E. B. HALL, Gen. Sup. M. P. & M., years of service 42, C. & N. W. (e) Witness enumerated four classes of accidents common to power reverse gears which have occurred on his railroad, and which have not been experienced with hand reverse gears. These classes are: 1st, cases where engines moved through engine house walls or into turntable pits because they move in direction opposite than indicated by lever; 2nd, men working about engines when air pressure is being pumped up, and gearing moving suddenly without anyone at the lever; 3rd, cases where men have been caught and injured upon intended movement of operating lever of power reverse gear in the cab by another employee; and 4th, the power reverse gear does not hold locomotive valve gear in the desired adjustment while locomotive is in motion (R. 1215-7).

JOHN NYE, years of service 8, D. & R. G. (c) Witness on Aug. 15, 1928, at Salt Lake roundhouse, had his left knee wrenched while renewing packing leathers in the reverse cylinder of power reverse engine. The iron bar which witness was using to pull in the packing leather slipped when the packing leather gave way and threw witness on the ground, being off duty 7 days (R. 1237).

JOHN MALONEY, age 61, years of service 30, C. & N. W. (a) Witness was severely bruised on Eng. 2307 some time in the year 1913 when dropping power reverse lever down and it started kicking and knocked him clear back against the cab. Off duty about a week (R. 1246-7).

(d) Witness described in detail accident happening to his fireman in 1922 or 1923 on Eng. 2551 when the power reverse gear stuck, and fireman attempting to pry it with shaker bar, the power reverse let go suddenly, striking him on the arm. Off duty about two weeks (R. 1247).

(e) The power reverse gear on Eng. 2307 would not

function while in the roundhouse; it was on center and would not move from that position. Roundhouse crew worked on it an hour before it would function, holding up the train for that length of time (R. 1247-8). Witness explained in detail another delay of 35 minutes to Eng. 2811 (Barco) in 1929 when power reverse gear failed to function. Finally got it started after hitting the link a jar and she let go (R. 1248).

Frank Persch, years of service 19, Erie. (b) On May 5, 1928, witness had one finger broken and another split while repairing the power reverse gear on Engine 220. Air pump was squealing. Witness had his hand on set screw which holds tumbling shaft. Asking the engineer to reverse the engine while he put valve oil on, it caught the tumbling shaft as it came over in back motion, causing the injury. Witness stated this accident could not have occurred with a hand reverse engine. Off duty 46 days (R. 1272-3).

W. P. Harris, age 54, years of service 33, Norfolk & Western. (a) On June 25, 1931, witness was operating a locomotive equipped with a Franklin Precision gear. He was assembling his train in the yard. While so engaged he had to double over and when the engine got on the apex of the hump he had to back through another track in order to get to the rear of his train and pull it in. The low pressure engine went over the apex of the hump and the witness started to reverse the gear and the reversing wheel kicked and caught his arm against the window and cut the arm open and bruised it so that he was off about four weeks and was unable to do much for about six or eight weeks afterwards. Witness received $2.50 a day for the time he was out of the service and, in addition, his doctor bills were paid (R. 1315).

HARRY L. EMSWORTH, age 47, years of service 29, Erie. (a) On June 27, 1931, witness was operating an engine equipped with a late model Franklin Precision gear. The brakeman had given him a signal to back up. Witness started to reverse the engine, made about two revolutions with the reverse wheel when it kicked back and the handle hit his wrist, breaking it. Was off duty 69 days and received $595 and in addition his doctor and hospital bills were paid (R. 1316).

R. I. LAMBRIGHT, N. Y. C. (formerly). On September 4, 1929, witness was a fireman on an engine equipped with a Ragonnet power reverse gear. The engineer's name was C. W. Ross. They were going through an interlocking plant when they heard something catch on the switch point and the engineer stopped and they found there was a brake beam down. They then pulled off the interlocking plant and cleared the road crossing and got down on the ground under the tender with tools to take the brakebeam out. As the witness got down, he noticed that the engineer had put the reverse gear on center, the operating lever being in the center of the quadrant and upright and cylinder cocks open. The witness and the engineer then got down under the tank and started working to take the beam out. Witness then went back on the engine to see that the water and fire was all right and then got down again and began helping the engineer. In a short while the engine started to move forward and witness got up in the cab to stop it. At that time he noticed that the operating lever of the power reverse was in forward position. No one had been in the cab in the meantime. Witness then got down on the ground to see what had happened to the engineer and found he had a crushed arm and appeared to have been struck on the

head—had a hole in his head. Witness stated this accident would not have happened if the engine had been equipped with a Johnson bar type of reverse gear. After the accident witness saw the operating lever of the power reverse creep forward from center position, slowly at first, a notch at a time until about 2/3 of the way down and then go faster to full forward position. He had not seen it do so previously. The latch was raised slightly but the spring not unnecessarily weak. The corner of the quadrant notches seemed to be rounded and if pressure were brought on the lever it would slip (R. 1316-8). B. of L. I. report show leakage of the power reverse air valve caused the reverse lever when placed on center to creep into full forward motion (Ex. 101, R. ~~1157-9~~). 15-67-9

FRED J. MILLER, N. Y. C. (a) Witness, who was District Claim Agent for the New York Central, testified in connection with the accident previously testified to by Witness Lambright and stated that $10,000 was paid Engineer Ross and that the expenses for hospital bills, nursing service, etc., amounted to $1,402.85. Doctor's bill was not included as Engineer Ross desired his own physician. Witness saw Engineer Ross on July 1, 1930. The right arm was amputated three or four inches above the elbow as a result of the injury. The injury to his head had resulted in an impairment to his left side which had disappeared somewhat by the spring of 1930, although he still had some weakness in his left arm. He at no time returned to work in any capacity and is now deceased (R. 1318).

S. W. MOLTE, years of service 34, Southern Pacific. (d) Witness testified that on the 5th day of August, 1931, he was backing up with two cars and was on a descending grade when his main reservoir pipe broke between the pump and the main reservoir which let all the

air escape out of the main reservoir. He tried to apply his brakes and found the air had nearly all drained out so he could not control the speed with the brakes. He immediately reversed the operating lever of the power reverse gear and, thinking there had been enough air to operate the reverse gear, gave the engine steam; but the gear did not reverse. Being unable to stop the engine, it ran backwards into train and the tank was sheared off and turned upside down. The witness was injured on the head, face and side. The fireman was badly hurt, having his leg broken in the thigh. The head brakeman had his ankle sprained. The fireman, according to the testimony of the witness, will probably remain in the hospital for six months. Witness did not have time to operate the steam connection to the power reverse. Witness states that this accident could have been avoided if he had had a hand lever reverse gear (R. 1318-21).

A. M. Collinson, Southern Pacific. (c) On August 27, 1931, witness saw an accident to the engineer while they were picking up cars. The witness endeavored to remove a pin after he had sprung the air on the train. Due to lack of slack he could not remove the pin. He gave a back-up sign and got no response and walked over to find out what was the matter. The engineer had gotten down and was looking around and found that the valve in the air supply pipe leading to the power reverse cylinder side was shut off. He turned it on, she backed up and his foot was crushed between the counterbalance and the side rod. As soon as the air was turned on, the air shot into the cylinder and she kicked back (R. 1323).

Engineer Brumfield, April 24, 1928, operating engine equipped with Precision power reverse gear, pulled his train into yard and stopped on incline. Upon releasing brakes preparatory to uncoupling reverse wheel kicked, breaking his right wrist joint. Inspection developed no defects whatever in engine or reverse gear (Ex. 86, R. 1560).

Note: The cases abstracted in Section IX, above, show injuries to 61 persons (including 9 deaths) and 30 accidents where no personal injuries resulted, in 21 of which property damage is shown.

X. Design, Characteristics, and Performance of Power Reverse Gears.

Descriptive circulars put out by several manufacturers of power reverse gears were put in evidence by the complainants, being Exhibits 3 (Alco), 8 (Franklin Precision), 9 (Barco) and 15 (Ragonnet), which include drawings and lists of parts of these gears. These exhibits are bound as a separate volume of the record herein (R. 1399, 1486). A reference to these circulars and drawings shows that all types of power reverse gears are constructed upon the principle of employing the force of compressed air to move the reversing gear in place of the muscular force used by the engineer in adjusting the reversing gear with the manually operated types. To accomplish this, a somewhat complicated mechanism has been developed, constructed about an air cylinder mounted on the side of the locomotive usually just below the running board outside of the cab and to the rear of the tumbling shaft. As may be seen from the drawings, this cylinder is constructed with a piston head upon either side of which air pressure from the main reservoir

air supply on the locomotive can be supplied or exhausted through the use of an air valve attached to or connected with the cylinder. The operation of the air valve is in turn controlled by either a lever moving in a quadrant, or a wheel, within the cab, mounted similarly and designed for operation similar to the manually operated reverse levers and wheels, except that the quadrants, levers and wheels are smaller (R. 266, 755, 1281). The principle of these gears, therefore, is that having adjusted the locomotive valve motion to a given point of cut-off, it will be maintained there by the presence of this air pressure on either side of the power reverse piston head. In the absence of any leakage of air and with the gears in 100 per cent condition, the position of the piston head in the air reverse cylinder frequently varies with the locomotive in motion and without any movement of the control lever or wheel. The piston moves in the power reverse gear cylinder as varying air pressure or pull disturbs the balance and overcomes the friction.*[1] To offset this movement the air valve is connected, by means of a "combination lever" or "floating lever" and connecting rod (Ex. 3, parts Nos. 22 & 23), with the piston stem or cross-head outside the gear cylinder in such a way that when the piston moves beyond a certain distance the air valve will have been moved sufficiently to admit air to the cylinder, build up pressure and automatically bring the piston back to position. This normal movement may take as long as 2 minutes or be completed in much less time (R. 1378-9). The resulting movement of the valve gear without the operating lever in the cab having been adjusted results in an undesired change in the point at which admission of steam to the cylinder is cut off. It is termed "creeping" (R. 58, 681).

*[1] This more or less constant movement wears the packing in the gear cylinder making it very difficult to keep the gear tight which is necessary to minimize "creeping" (R. 652).

The combination lever is also connected with the reach rod leading to the control lever or wheel in the cab, thus furnishing a physical connection between the controls and the valve gear. (Exh. 3, 9 & 15; R. 660-1, 609, 761-2). The Precision gear has this direct connection through the piston stem without the use of a combination lever (Exh. 8; R. 1377-8; 1380-1, 761-2).

In case of any leakage of air occurring at the power reverse gear cylinder, or the valve or other pipes or fittings (R. 739), a considerably greater and often more rapid movement of the power reverse piston occurs, due to an unequal pressure on the two sides of the piston head. This, too, is commonly called "creeping" (or "floating") (R. 681, 1144-7, 1133-5, 1172-3, 880-2, 1120, 898-9), and the more violent cases of creeping are called "pumping" (R. 522-7, 483-5, 540-1, 545-7, 558, 609). Other variations of creeping are called "jumping" (R. 647, 767, 803, 1182-3, 1265), "lunging" (R. 674) and "shimmying" (R. 1248-9). All are common to all makes of power gears and signify erratic performance due to the "air-cushion" principle employed.

The fit and lap of the air valve is cut down to a very small margin—as low as 1/32 of an inch in some cases (R. 1380). The power reverse mechanism consists of a considerable number of separate parts which, assembled together, form this auxiliary air motor. As shown by Exhibit 3, the Alco gear has fifty-four separate parts, many of which are small and have to be finished and maintained very carefully in order to make them air tight. There are 9 moving parts on a hand reverse gear and 25 such parts on the Alco gear (R. 880-2). The Ragonnet is practically the same gear as the Alco, having, however, somewhat fewer parts (Exh. 15). The Barco in an endeaxor to get away from the unsuitability of an air cushion to maintain a fixed point of cut-off, has adopted

a worm gear and rack arrangement as shown in the cuts (Exh. 9; R. 530-1) and the Franklin Precision for the same purpose has adopted the screw type of control and gear operation (Exh. 8; R. 1381-2).*[2] It has 75 parts (R. 1267).

All of them depend upon the presence and maintenance of air pressure on the locomotive for their operation. In case of an emergency where such air pressure is not present, the Alco and Ragonnet types depend upon the presence of an auxiliary steam pressure line which may be cut-in to be used in place of the air pressure. The Barco also is designed for the use of such auxiliary steam line in case of air failure, and it also is so arranged that by removing a cap a wrench can be used if one is in a position to reach the gear, and in that way the valve motion may be slowly manipulated (R. 527). The Precision (screw type) is designed so that in case of air failure it will be possible to reverse the engine by slow stages and by use of an unusual amount of strength with the small hand wheel (R. 1377-8, 1380-1, 1189). This gear is a much slower gear in operation, however, than any other gear—either hand or power—and often harder to operate (R. 1093, 1095, 750, 755, 1100, 1103). It is not suitable for use in switching or way-freight service or in any service where frequent reversing of the engine is required (R. 1183). The record shows only three switch engines equipped with Precision gears (Ex. 58, R. 1501-36, 1514).

From the above it is apparent that the comparison of any one of these several makes of power reverse gears with either type of manually operated reverse gear, involves the comparison of a rather complicated and quite delicately adjusted auxiliary motor or machine, with a simple tool (R. 1212).

*[2] Notwithstanding these efforts, all power reverse gears "creep" to a marked degree.

OPINION

SUPREME COURT OF THE UNITED STATES.

No 221.—October Term, 1934.

United States, et al., Petitioners, *vs.* Baltimore & Ohio R. R. Co., et al.	On appeal from the District Court of the United States for the Northern District of Ohio.

[January 7, 1935.]

Mr. Justice Brandeis delivered the opinion of the Court.

This is a direct appeal from the decree of the federal court for northern Ohio, setting aside an order, under the Boiler Inspection Act, entered by the Interstate Commerce Commission on January 5, 1933.

At the date of the order there were in use in the United States about 31,597 steam locomotives equipped with hand reverse gear and 28,925 equipped with power reverse gear.[1] Prior to the order, Rule 157, which prescribes the reverse gear on locomotives, left it optional with railroads to equip them with either hand operated or power operated reverse gear.[2] The order amended that rule

[1]As described in the carriers' bill: "The reversing gear, or 'reverse gear' as it is usually called, of a steam locomotive is the mechanism which controls the position and movement of the locomotive valve gear and valves which admit steam in the cyclinders, and it is by means of this mechanism that the direction of movement of the locomotive is controlled, and the proper and economical use of steam is accomplished. Two general classes of reverse gears are in use, viz: (1) Manually operated reverse gears which depend upon the use of muscular force of the engineer and the force exerted by the counterbalancing weights and springs, for their operation; and (2) power reverse gears which supplement the above mentioned forces with an auxiliary mechanism which, in normal operation, brings the force of compressed air into play, so that less muscular effort is normally required to be put forth by the engineer in using this type of gear. The engineer operates either class of gear by means of either a lever or handwheel (used with screw type of gear) located near his seat-box in the locomotive cab."

[2]Rule 157: "Reversing Gear.—Reversing gear, reverse levers, and quadrants shall be maintained in a safe and suitable condition for service. Reverse lever latch shall be so arranged that it can be easily disengaged, and provided with a spring which will keep it firmly seated in quadrant. Proper counter balance shall be provided for the valve gear."

so as to require the railroads to equip "with a suitable type of power operated reverse gear" all steam locomotives built on or after April 1, 1933; and similarly to equip, "the first time they are given repairs defined by the United States Railroad Administration as Class 3, or heavier", all steam locomotives then in road service "which weigh on driving wheels 150,000 pounds or more", and all then used in switching service "which weigh on driving wheels 130,000 pounds or more." The order required that, in any event, all such steam locomotives be so equipped before January 1, 1937; and that "air operated reverse gear [including thus power gear already installed] shall have a suitable steam connection" so arranged "that in case of air failure steam may be quickly used to operate the reverse gear." *A. Johnson* v. *Atlantic Coast Line R. R.*, 190 I. C. C. 351.

The order of the Commission was entered on a complaint of the Brotherhood of Locomotive Engineers and the Brotherhood of Locomotive Firemen and Enginemen. The complaint alleged, in substance, that while power reverse gear is a suitable, safe and practical device, manually operated reverse gear is inherently unsafe and unsuitable in principle and design; that it subjects employees and the traveling public to unnecessary peril; and that the use of locomotives equipped with hand reverse gears violates the Boiler Inspection Act. The complaint prayed that the Commission prescribe rules requiring that all steam locomotives be equipped "with power reverse gear, or other devices adequate to protect the employees upon said locomotives from unnecessary peril to life or limb, as provided in section 2," of the Act.

Practically all the railroads of the United States were made respondents. They challenged in their answers the jurisdiction of the Commission on the grounds that the procedure was unauthorized and that a power reverse gear was not a safety device or appliance within the meaning of § 2 of the Boiler Inspection Act; denied the essential allegations of the complaint; and, as additional reason for refusing its prayer, set up the impaired financial condition of the carriers. These issues were referred for hearing to an examiner. Fifty-five days were devoted to the taking of testimony. The witnesses numbered 337. Their testimony covered 6,491 pages. There were introduced, in addition, 109 exhibits, many of them voluminous. The proposed report of the Examiner occupies 40 pages

of the printed record in this Court; and the railroads' exceptions to it, 60 pages. The exceptions were heard by a Division of the Commission consisting of three members; and reargument before the whole Commission was denied.

This suit to set aside the order was brought by Baltimore & Ohio Railroad and other carriers, suing on behalf of themselves and substantially all the other railroads. The original defendant was the United States. The Commission, Grand Chief Johnson of the Brotherhood of Locomotive Engineers and President Robertson of the Brotherhood of Locomotive Firemen and Enginemen are defendants by intervention. The case was heard by the District Court, three judges sitting, on a transcript of the record before the Commission. The railroads again contended that the Commission lacked authority to entertain the complaint. They insisted also that the order was void for lack of essential findings of fact. These objections were overruled. But the court, citing among others, *The Chicago Junction Case,* 264 U. S. 258 and *United States* v. *Abilene & Southern Ry. Co.,* 265 U. S. 274, set the order aside, on the ground that the Commission had acted arbitrarily, in failing to give consideration and legal effect to pertinent, uncontradicted facts having a controlling bearing upon the issues, and in disregarding undisputed evidence. 5 F. Supp. 929. An appeal to this Court by all the defendants was allowed. The appellants contended that the action of the District Court constituted substitution of its judgment for that of the Commission. The argument here was devoted, in large part, to the consideration of the findings of the lower court charging disregard by the Commission of the evidence before it. For reasons which will be stated later, we have no occasion to enter upon that enquiry.

First. The Commission clearly has authority, in an appropriate proceeding, to forbid the use of a locomotive equipped with a manually operated reverse gear if, by reason thereof, the engine is rendered unsafe or subjects employees of the railroad or others to "unnecessary peril to life or limb." The substitution of power operated reverse gear for manually operated reverse gear, might conceivably be found necessary to promote safety, even if it did so only indirectly by preventing the impairment of the health of engineers through excessive exertion or fatigue. To require the installation of power operated reverse gear is, in its nature, within

the scope of the authority delegated to the Commission. For "the power delegated to the Commission by the Boiler Inspection Act as amended is a general one.[3] It extends to the design, the construction and the material of every part of the locomotive and tender and of all appurtenances." *Napier* v. *Atlantic Coast Line*, 272 U. S. 605, 611.

Second. The railroads contend that in the proceeding under review, the Commission lacks authority to make any change of the existing rule concerning reverse gears; that authority to initiate changes in existing rules was denied to it; that the rules governing boilers and their appurtenances approved June 2, 1911, and the additional ones governing locomotives, tenders and appurtenances approved October 11, 1915, cannot be changed except upon application of the carriers or with their consent. The argument is that the Boiler Inspection Act is an independent and complete piece of legislation and thus the Commission is denied in respect to locomotives those general powers which it exercises in other connections; that by the original Act of 1911 the right to initiate rules was by § 5 conferred not upon the Commission, but upon the several railroads and, only to the extent that one or more of the carriers failed to act within three months, upon the chief inspector; that the Commission's power of requiring modifications was limited to the rules originally filed; that in respect to subsequent changes therein, its sole function is that of approval or disapproval of the carriers' proposals; and that the Commission's only other authority in respect to locomotives is that, conferred by § 6, of reviewing the action of the chief inspector in declaring individual locomotives unfit for service.

To hold that the authority of the Commission is thus limited would defeat, in large measure, the purpose of the legislation; and would be inconsistent with long established practice. Congress imposed the strictly administrative duties, in the main, upon the chief inspector. But it specifically directed, in § 6, that the "first duty [of the district inspectors] shall be to see that the carriers make inspections in accordance with the rules and regulations established or approved by the Interstate Commerce Commission." Upon the Commission, were conferred, besides some strictly ad-

[3] February 17, 1911, c. 103, § 2, 36 Stat. 913; amended March 4, 1915, c. 169, 38 Stat. 1192; June 7, 1924, c. 355, 43 Stat. 659.

ministrative powers, both quasi-legislative and quasi-judicial functions. The latter it was authorized to exercise only in the appellate capacity of reviewing, under § 6, orders of the chief inspector declaring an individual locomotive unserviceable. Its legislative power was to be exercised in the making of rules. Section 5 of the original Act provided that "each carrier subject to this Act shall file its rules and instructions for the inspection of locomotive boilers with the chief inspector within three months after the approval of this Act, and after hearing and approval by the Interstate Commerce Commission, such rules and instructions, with such modifications as the commission requires, shall become obligatory upon such carrier". When this Act was passed, in 1911, there were doubtless already in force on each railroad some rules established by the carrier. And likewise, in 1915 and in 1924, when the scope of the Act was extended, there were doubtless in force on each railroad rules established by the carrier governing parts, appurtenances or engines, not falling within the field covered by the previously existing legislation. Naturally those carrier-rules would be the starting point in the Commission's rule making; and, naturally, it would be much influenced, as well as instructed, by the chief inspector's proposals or recommendations. But the responsibility for rules adequate to ensure safety was imposed by Congress upon the Commission; and to discharge that duty, it was essential that the Commission, also, should possess the initiative in rule making. To this end, it was granted the power, not only of disapproving proposed rules, but also of requiring modifications of those in force. The power so conferred may obviously be exercised, as was done here, on complaint of the Brotherhoods representing employees directly affected.

In the *Napier* case, the question directly before the Court was not the authority of the Commission to initiate rules. It was the validity of state laws and rules prescribing specific safety devices on locomotives. But the objection now raised by the railroads was discussed by counsel and was considered by the Court. The validity of the State laws and regulations was challenged on the ground that the Boiler Inspection Act had occupied the field; and as the question whether it had done so was one of statutory construction, the provisions of the Act were necessarily examined. The conclusion that the Commission possesses the authority to make rules on its own initiative, or upon complaint, was the basis of the decision there made. (See pp. 611-613.) Referring to the argument of

the States "that the authority delegated to the Commission does not extend to ordering the use or installation of equipment of any kind, *Baltimore & Ohio R. R. Co.* v. *Groeger,* 266 U. S. 521," we said: "The duty of the Commission is not merely to inspect. It is, also, to prescribe the rules and regulations by which the fitness for service shall be determined. Unless these rules and regulations are complied with, the engine is not 'in proper condition' for operation. Thus the Commission sets the standard. By setting the standard it imposes requirements. The power to require specific devices was exercised before the amendment of 1915 and has been extensively exercised since." In closing the opinion, we added: "If the protection now afforded by the Commission's rules is deemed inadequate, application for relief must be made to it. The Commission's power is ample."

In the *Napier* case this Court listed in the margin 18 rules which had, before 1925, been amended by order of the Commission.[4] Acting upon the suggestion there made by this Court, the state authorities and the Brotherhoods applied to the Commission for relief in proceedings similar to those here under review and rules were prescribed by it. All the railroads either conceded its authority to do so or acquiesced in its final orders. *Cab Curtain Case,* 142 I. C. C. 199, 201; *Fire Door Case,* 151 I. C. C. 448, 450. Compare Rules for Testing other than Steam Power Locomotives, 122 I. C. C. 414; *Staten Island Rapid Transit Ry. Co.* v. *Public Service Commission,* 16 F. (2d) 313.

Third. The railroads contend that to support the order certain basic findings are essential; that these were not made; and that, hence, the order is void. This contention is in our opinion sound. The Act does not confer upon the Commission legislative authority to require the adoption on locomotives of such devices as, in its discretion, it may from time to time deem desirable. The operation of an engine, however equipped, involves some "danger to life or limb." At common law the carriers were "free to determine how their boilers should be kept in proper condition for use without

[4]The railroads state that the Commission's orders disclose that "a considerable number" of the changes were brought about as a result of conferences between the chief inspector and committees representing all the railroads, or upon requests of representatives of the carriers, which modifications were agreed to by the representatives of the employees interested and by the chief inspector.

unnecessary danger." *Baltimore & Ohio R. R. Co.* v. *Groeger,* 266 U. S. 521, 529. And the Act conferred authority to prescribe by rule specific devices, or changes in the equipment, only where these are required to remove "unnecessary peril to life or limb." The power to make the determination whether the proposed device or change is so required, vests in the Commission. But its finding to that effect is essential to the existence of authority to promulgate the rule; and as Congress has made affirmative orders of the Commission subject to judicial review, *The Chicago Junction Case,* 264 U. S. 258, 263-265,[5] the order may be set aside unless it appears that the basic finding was made. *Florida* v. *United States,* 282 U. S. 194.

The primary question of fact presented for determination was, as the report of the Commission states, "whether the use of locomotives equipped with hand reverse gear, as compared with power reverse gear, causes unnecessary peril to life or limb." The report discusses, at some length, the alleged advantages and disadvantages of the two classes of reverse gear and the expense which the proposed change would entail; and concludes with "findings" that, to a certain extent, the change should be made.[6] But whether the use of any or all types of steam locomotives "equipped with hand reverse gear as compared with power reverse gear causes unnecessary peril to life or limb", is left entirely to inference. This complete absence of "the basic or essential findings required to support the Commission's order" renders it void. *Florida* v. *United*

[5]Compare United States *v.* Atlanta, B. & C. R. Co., 282 U. S. 522, 527-529.

[6]The closing paragraphs of the report are: "On the record in this case we conclude and find that the safety of employees and travellers on railroads requires that all steam locomotives built on or after April 1, 1933, be equipped with a suitable type of power-operated reverse gear.

"We further find that all steam locomotives used in road service built prior to April 1, 1933, which weigh on driving wheels 150,000 pounds or more, and all steam locomotives used in switching service built prior to April 1, 1933, which weigh on driving wheels 130,000 pounds or more, shall have such power-operated reverse gear applied the first time they are given repairs defined by the United States Railroad Administration as class 3 or heavier; and that all such locomotives shall be so equipped before January 1, 1937.

"We further find that air-operated power reverse gear should have a suitable steam connection so arranged and maintained that it can quickly be used in case of air failure.

"An appropriate order amending our rules for the inspection and testing of steam locomotives and tenders and their appurtenances to give effect to these findings will be entered."

States, 282 U. S. 194, 215. Compare *Wichita Railroad & Light Company* v. *Public Utilities Comm.*, 260 U. S. 48, 58-59; *Mahler* v. *Eby*, 264 U. S. 32, 44-45.[7]

In the *Florida* case the legal distinction was pointed out between what may be termed quasi-jurisdictional findings, there held to be indispensable, and the "complete statement of the grounds of the Commission's determination" which was declared in *Beaumont, Sour Lake & Western Ry. Co.* v. *United States*, 282 U. S. 74, 86, to be desirable for a proper consideration of the case in the courts. The lack of such a complete statement, while always regrettable, because unnecessarily increasing the labor of the reviewing court, compare *Virginian Ry.* v. *United States*, 272 U. S. 658, 675, is not fatal to the validity of the order. It is true that formal and precise findings are not required, under § 14 (1) of the Interstate Commerce Act, which declares that the report "shall state the conclusions of the Commission together with its decision".[8] Compare *Manufacturers Ry. Co.* v. *United States*, 246 U. S. 457, 487; *Meeker & Co.* v. *Lehigh Valley R. R.*, 236 U. S. 412, 428. That provision relieves the Commission from making comprehensive findings of fact similar to those required by Equity Rule 70½. But § 14 (1) does not remove the necessity of making, where orders are subject to judicial review, quasi-jurisdictional findings essential to their constitutional or statutory validity.[9]

Affirmed.

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[7]The objection presented here is similar to that urged upon the Court in United States *v.* Louisiana, 290 U. S. 70, 80. There, however, the Court was satisfied that the essential findings had been made, although "the particular form in which they were cast [was] not to be commended." Compare Georgia Comm. *v.* United States, 283 U. S. 765, 773; Alabama *v.* United States, 283 U. S. 776, 779; Louisiana Public Service Comm. *v.* Texas & N. O. R. R., 284 U. S. 125, 132; Illinois Commerce Comm. *v.* United States, 292 U. S. 474, 481-483; Ohio *v.* United States, 292 U. S. 498, 511; State of Montana *v.* United States, 2 F. Supp. 448, aff. 290 U. S. 593; Commonwealth of Kentucky *v.* United States, 3 F. Supp. 778. See, too, New York *v.* United States, 257 U. S. 591, 600.

[8]The original Act of February 4, 1887, c. 104, § 14, 24 Stat. 384, which had prescribed that the report should "include findings of fact upon which the conclusions of the Commission are based," was amended by § 3 of the Act of June 29, 1906, c. 3591, 34 Stat. 589, so as to require (except in reparation cases) that it shall make a report "which shall state the conclusions of the commission together with its decision, order, or requirement in the premises."

[9]A different rule has been applied to executive action not subject to review. Compare Philadelphia & Trenton R. R. *v.* Stimpson, 14 Pet. 448, 458; United States *v.* Chemical Foundation, 272 U. S. 1, 14-15.